THE PHILIPPINE
JOURNAL OF SCIENCE
D. GENERAL BIOLOGY, ETHNOLOGY,
AND ANTHROPOLOGY

VOL. XII JULY, 1917 No. 4

SEA PRODUCTS OF MINDANAO AND SULU, III: SPONGES, TORTOISE SHELL, CORALS, AND TREPANG

By ALVIN SEALE

(From the Section of Fisheries, Biological Laboratory, Bureau of Science, Manila)

FOUR PLATES

SPONGE FISHERIES

There are several good sponge beds in the Sulu Archipelago, and as there has been but little prospecting for sponges, it is probable that many beds remain to be discovered among the numerous islands that constitute the southern part of the Philippine Islands.

LOCATION OF THE PHILIPPINE SPONGE BEDS

The Sitanki beds.—In 1907 two Americans, Messrs. Johnson and Byersdoff, discovered near Sitanki Island the first bed of commercial sponges known in the Philippine Islands. They shipped to markets in the United States and Europe about 3,000 kilograms of sponges.

These beds are in shallow water and practically cover the great Sitanki reef. Several varieties of grass sponges are exceedingly abundant on these beds, and a canoe load can be gathered in an hour. These are fragile and of little value. On the edge of the reef in deeper water a much better kind of sponge is found. This is a variety of wool sponge, which I have named the Sulu Sea bath sponge. It is a large, tough-fibered, coarse sponge and is unknown to the American trade, there being nothing like it on the Florida or the Bahama beds. It is excellent for ordinary work about boats or stables and for persons

who like a vigorous bath. I have found that it will outlast the ordinary Florida wool sponge for such uses. All of the sponges from these beds have been secured by wading or by employing naked Moro divers, who were not very familiar with sponges. It is probable that if these beds were properly prospected with a diving outfit sponges of greater value would be found.

The Tawi Tawi beds.—The Tawi Tawi sponge beds are scattered over a wide area. The great majority of the numerous reefs and islets near Tawi Tawi Island have sponges of various kinds growing about them. The reef surrounding Tijitiji Islets and extending as far north as Bilatan is a prolific portion of this bed. At Banaran, Secundum, Latuan, Tundubas, South Ubian, and Kinapusan Islands some very good sheep's-wool sponges have been secured. The deeper waters about these islands have not been prospected with diving outfits. A sponging concession at Kinapusan Island was granted to Mr. Bruen for the Philippine Sponge Company in December, 1915. I have examined some excellent sheep's-wool sponges taken from this concession. A peculiar sheep's-wool sponge that is dark red on the inside is taken in the channel between Latuan and Mantabuan Islands.

Sponging operations on the Tawi Tawi beds consist in hiring Moros to wade over the reefs and gather shallow-water sponges in baskets. They are paid very little for their work, and most of the sponges they secure are fragile and of a very inferior grade. Sponges taken from deeper water are of much greater value.

The Siasi beds.—The first genuine sheep's-wool sponge found in the Philippines was secured by me at Sitanki Island in 1907. Some years later this sponge was shown to Doctor Moore, sponge expert of the United States Bureau of Fisheries, and he pronounced it "an imported Florida wool sponge." More than 1,000 kilograms of the same or a better grade of sheep's-wool were taken from the Philippine beds during 1915. Siasi is the operating center of the Philippine Sponge Company, of which Mr. McGrath, of Manila, is president. The field operations are directed by four Americans, who are without previous experience in sponging. They have expended about 25,000 pesos.[1] Their plant consists of storehouses, cleaning vats, corrals, boats, and wharf. They have exported 3,080 kilograms of sponges with a declared customs value of 43,000 pesos.

[1] One peso Philippine currency equals 100 centavos, equals 50 cents United States currency.

I understand that a large portion of these sponges were shallow-water varieties gathered by the Moros wading on the reef. A much better grade of sponges could be secured in water of from 5 to 10 fathoms. An excellent grade of sheep's-wool sponge can be secured on the Siasi beds.

Basilan beds.—There are extensive beds of elephant's-ear sponges on the reefs of Bihintinusa Island, south of Basilan; at Takela and Tengolan Islands; and near the lighthouse on Malamaui Island. There has been very little systematic prospecting of the Basilan sponge beds, and our knowledge of them is very fragmentary.

Zamboanga beds.—The Zamboanga sponge beds were discovered by the Greek diver on the Bureau of Science sponge boat leased for a short time during the present investigation. This bed is in water from 5 to 20 fathoms deep and extends from near the mouth of Honda River seaward into deeper water, then northward to a point offshore from the constabulary quarters. The sponges on this bed are honeycomb wool of a good grade and a thick, tough elephant's-ear. This bed has never been worked and would repay exploitation.

Sacol Island beds.—The Sacol Island beds, which are located in from 6 to 18 fathoms of water on the southwest side of Sacol Island, were discovered by a company of eight experienced Greek spongers, of which Mr. P. I. Pipinos is the head. This company has secured 800 kilograms of sponges from this bed, all of the honeycomb wool variety and of excellent size and grade.

VARIETIES AND VALUES OF PHILIPPINE SPONGES

There are three well-marked classes of commercial sponges found in the Philippines. These are the wool, the grass, and the elephant's-ear. Of the wool sponges the following varieties occur:

The sheep's-wool sponge.—This sponge (Plate II, fig. 4) is in every respect similar and equal to the well-known sheep's-wool sponge of Florida and grows to the same size. I have examined specimens 20 centimeters in diameter, although the average size is much less. This sponge has a strong, soft, elastic fiber. It is found in large quantities on the Tawi Tawi and the Siasi beds and grows best in water of from 6 to 10 fathoms. It is valued at from 10 to 30 pesos per kilogram.

The honeycomb sponge.—The honeycomb sponge (Plate II, fig. 3) is a variety of wool sponge with a somewhat coarser fiber than the sheep's-wool and with the canals resembling honey-

comb. It is a strong sponge and for ordinary use is very serviceable. It holds water well, is elastic, and is very durable. This sponge is known only from the Sacol and the Zamboanga beds, where it is abundant in waters of from 6 to 18 fathoms. The experienced Greek spongers pronounced this an excellent sponge and have exported several hundred kilograms; quotations received were 5 pesos per kilogram.

The Sulu Sea bath sponge.—The Sulu Sea bath sponge (Plate II, fig. 2) is another variety of the wool sponge. It has an extremely long, coarse fiber and is probably the most durable sponge found in Philippine waters. I have been using sponges of this kind for the last eight years and find them most satisfactory. This sponge is only known from the Sitanki beds. It is little known to the American trade, and I am unable to give any quotations of value.

Philippine zimocca sponge.—There is considerable doubt as to the classification of the Philippine zimocca sponge (Plate II, fig. 5), which is unknown to the American trade. Some experts say that it is intermediate between the wool and the grass sponges, while some experienced spongers say that it is most nearly related to the European zimocca. It is very tough and has a fine, closely knit fiber. It is usually flat and measures from 15 to 20 centimeters in diameter. It is found on the Tawi Tawi, the Sitanki, and the Siasi beds on rocky bottom and in shallow water. It is not very abundant; the only quotations received placed its value at from 6 to 10 pesos per kilogram.

The following varieties of the grass sponge of commercial value occur in Philippine waters:

The common grass sponge.—The common grass sponge (Plate II, fig. 6) is a soft-textured, moderately fragile, nicely shaped sponge from 20 to 30 centimeters in diameter. The best grades of this sponge are found in water of from 3 to 5 fathoms. It is common on the reefs of practically all the sponge beds. The best selected grades of this sponge are worth from 2 to 6 pesos per kilogram.

The Philippine reef sponge, or glove sponge.—This is a variety of grass sponge. It is a very soft and beautiful sponge, but unfortunately it is fragile and, therefore, can be used only a short time. It is found in shallow water on almost all reefs in the Sulu Archipelago. It is of little commercial value.

The Philippine silk sponge.—This is a small variety of grass sponge with a beautiful, soft, silky texture. It is usually from 10 to 15 centimeters in diameter and may be the young of the

common grass sponge. It is not so fragile as the ordinary reef sponge.

Elephant's-ear sponges.—Of the elephant's-ear, or cup, sponge there seem to be but two varieties in the Philippines. One of these is a very fragile, shallow-water form of very thin, rough texture, of white or greenish color, and of no value. The other is the genuine commercial elephant's-ear similar in all respects to the elephant's-ear found in the Mediterranean Sea. This sponge is pink when fresh from the water; the walls are soft and very tough and are from 1 to 1.5 centimeters thick. The valuable variety of elephant's-ear sponge is found only in water of from 6 to 20 fathoms and is very common on the Basilan, the Zamboanga, and the Sacol beds. It is also probably common on other beds, but no deep-water divers have yet prospected for it in other places.

Mr. P. I. Pipinos, of the Greek Sponge Company operating from Zamboanga, who is an experienced Mediterranean sponge dealer, has cured and exported these sponges, and he pronounces them equal to the elephant's-ear of the Mediterranean. This sponge is practically unknown to the American trade. Mr. Pipinos gives its value at about 24 pesos per kilogram. The market is wholly European.

This sponge is used for the most expensive grades of padding for helmets, racing saddles, etc. It is also used by glaziers in finishing their products.

OCCURRENCE AND GROWTH OF SPONGES

Commercial sponges in their natural state have very little resemblance to the cured and bleached specimens seen in the druggest's window. When first taken from the water, sponges are soft, slimy, irregular, and unattractive. In color they are black, brown, gray, or green.

The living sponge is covered with a thin skin, and its body is traversed by irregular canals, which open to the surface by large pores. Usually there are many fragments of coral, shell, and other foreign material embedded in the sponge body.

Sponges grow best on a sandy bottom that is well overgrow with eelgrass or algæ. On a rocky bottom they are apt to be of poor shape. Sponges are hermaphroditic and reproduce by two methods: namely, by budding and sexually. After fertilization the eggs rapidly attain the free-swimming stage are expelled from the body, and are carried far and wide by the tides. After a short period they settle to the bottom, attach

themselves to rocks or shells, and grow. A sponge attains marketable size within two or three years.

Sponges have been successfully cultivated in several countries, the method being as follows: The sponge is held under sea water and with a sharp knife is cut into suitable pieces, usually from 5 to 10 centimeters square. It is best not to remove the sponge from the water at any time. The cuttings are strung on rattan, bamboo, or copper or tin wire, or are fastened to a smooth tile or to a cement base, and are replaced in a convenient bed in the sea and left to grow. They should be planted in the same depth of water as their original home, as sponges from deep water do not grow well in shallow water, and those from shallow water do not thrive in deep water. The Australian Government has experimented with sponge growing for six years with considerable success, and some experiments have been conducted by the United States Bureau of Fisheries on the Florida beds.

METHODS OF CURING, GRADING, AND MARKETING SPONGES

There are several methods of preparing sponges for the market, and the treatment must be adapted to the class of sponge; for example, the fragile grass sponge should not be given the same treatment as the tough Sulu Sea bath or the honeycomb sponge.

The experienced Greek spongers, who conducted their work with a 5-ton boat equipped with diving outfit, air pump, and crew of six men, used the following method in handling their wool sponges: As soon as caught, the sponges were placed right side up on deck; after four or five hours they were trampled by the feet and strung on strong cords about 2 meters in length. These strings of sponges were hung over the sides of the boat in the water. As time would permit within the next twenty-four hours, a string at a time was taken on deck and squeezed and washed again, until the skin and other soft organic matter were removed. The clean sponges were hung in the rigging to dry, after which they were stored on board until the boat came in from her cruise. As soon as the sponges were landed, they were spread out in the warehouse and were carefully gone over one by one, all of them being beaten with a smooth, rounded club against a solid log to remove all shells, sand, and other foreign matter. The sponges were next passed to the trimmers, who trimmed them into good shapes with sheep shears. After this

the sponges were sorted into grade and sizes, thoroughly dried, baled into sacks, and stored until shipped.

This method has the advantage that the sponges are allowed to remain in the water only a short time after being gathered and so are not rotted as is often the case when sponges are placed in corrals. The elephant's-ear sponges were treated in the same manner, but were not pounded and so required less time to clean.

The common method of cleaning sponges—a necessary one where great quantities of sponges are handled—is as follows: The sponges are gathered and placed upright on shore until dead—from a few hours to a day usually being required. They are then placed in a bamboo corral, which is built in shallow water. The corral should have a bottom of bamboo, boards, or rocks to keep the sponges off the ground. The sides should be of stakes, wire net, or bamboo, so that the water can circulate freely over the sponges. The attendant must go over the sponges continually, squeezing out the dead matter and cleaning them. Some spongers leave the sponges in this corral two or three days, but I am convinced that this is too long and rots the tissues. The sponges should be cleaned as soon as possible. If they remain but a few hours in the water, so much the better for the sponges; in fact, the fragile reef and grass sponges should be washed out at once. If these instructions are followed, a more durable quality of grass sponge will result. When clean the sponges should be beaten with a smooth, rounded club, and all shell, coral, and sand should be removed. They should then be trimmed, sorted, graded, and thoroughly dried, after which they may be packed and shipped. Sponges should at all times be kept off the ground; otherwise they rot. They also heat and rot if left uncleaned in a boat for several days. A boat working more than one day distant from the corrals should follow the Greek method of curing on ship board. If sponges are left in water or are exposed to rain, they turn red or bright yellow and rot. Lack of care in handling and cleaning has gone far toward spoiling the American market for Philippine sponges, as can be seen by the following letter from a large wholesale house in Chicago:

> The small silk sponge which is very close grain and soft is taken from water which is so shallow that the sponge falls to pieces when being bleached and is practically of no value. We also have something which looks like a Sheepswool sponge but it is not properly cleaned, the sponge life still remains in the sponge making it heavy. Now, if your people would

fish in 20 or 30 feet of water, trim their sponges with shears until they are smooth all around, sort them into bales in accordance with size, packing goods about as follows: 1 to 3, 3 to 6, 6 to 10, 10 to 16 and 16 to 20 pieces to the pound and separate the different grades and varieties, we would then be able to handle them to much better advantage. Labor is quite an item on these goods over here but of course it would not amount to so much there.

The whole perfect sponge is called a "form," those with crab holes and other imperfections are called "seconds," while cut pieces are known as "cuts." The sizes are named from the number of pieces required to make up a pound, being "ones, twos, 2–3, 3–4, 4–6, 6–8, 8–10, 10–12, 12–16, 16–20." Rings through which the sponges are passed are sometimes used to determine the exact sizes.

I would advise the following method in grading sponges, which is employed in the sponge fisheries of the United States: Sort as to kinds—these may be sheep's-wool, honeycomb wool, zimocca, Sulu Sea bath, grass, or elephant's-ear—and pack according to sizes. Select a reliable house to handle the goods in the American or foreign markets. There has been much complaint among the Philippine spongers that their goods are not handled in a satisfactory manner by American sponge houses, but it can scarcely be expected that an American sponge house with a large stock of Florida and Bahama sponges on hand will exert much effort in marketing Philippine sponges, unless there is some special reason for such exertion.

RECENT SPONGING ACTIVITY

During an inspection trip to the southern islands in December, 1915, considerable new information regarding the Philippine sponge fisheries was secured.

The Philippine Sponge Company had entered the field and expended about 20,000 pesos on a plant for the proper cleaning, curing, and storing of sponges, and had shipped 2,000 kilograms of sponges to the United States market—chiefly sheep's-wool.

A company under the direction of Mr. Pipinos, an experienced sponger, was operating successfully with diving outfits in the waters near Zamboanga. In waters of from 10 to 14 fathoms it secured about 1,800 kilograms of an excellent grade of honeycomb and elephant's-ear sponges. Several individuals were engaged in gathering from the reefs quantities of shallow-water sponges of no great value.

At the request of Governor Carpenter, a bill was drafted for the proper regulation and control of the sponge fisheries. This act was passed and became effective February 5, 1916.

THIRD PHILIPPINE LEGISLATURE.

Fourth session.

A. B. No. 1571.

[No. 2584.]

AN ACT REGULATING SPONGE FISHERIES IN THE PHILIPPINE ISLANDS.

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. Except as provided in this Act, it shall be unlawful to fish, collect, or gather sponges from the sea bottom or reefs within a radius of three marine leagues from any land within the territorial limits of the Philippine Islands.

SEC. 2. The Secretary of the Interior may grant concessions for the fishing for, collecting or gathering of sponges in any waters of the Philippine Islands, to the following:

(*a*) Citizens of the United States or of the Philippine Islands.

(*b*) Honorably discharged soldiers or sailors of the Army or Navy of the United States.

(*c*) Corporations duly organized under the laws of the Philippine Islands.

(*d*) Persons who have under and by virtue of the Treaty of Paris acquired the political rights of natives of the Philippine Islands.

SEC. 3. All applications for concessions shall be made to the Secretary of the Interior and be accompanied by a description giving latitude and longitude indicated upon a chart of the region desired, the latest published charts of the United States Geodetic Survey being taken as the basis of the plot. Such applicants must take oath in proper form that the said area does not conflict in any way with any concession already granted or occupied. If the Secretary of the Interior should become satisfied of the financial responsibility of the applicant, the concession may be granted, subject to the proper erection and location of marks and buoys. All concessions must be marked at each corner with properly anchored buoys, and in shallow water, description of boundary marks must be submitted.

All persons working under a concession or permit must at all times carry in their possession copy of such concession or permit ready to exhibit the same upon demand by any peace officer or other persons designated by the Secretary of the Interior to enforce the provisions of this Act.

SEC. 4. The annual concession fee shall be twenty-five pesos per square kilometer. Concessions granted in accordance with this Act shall be for the sponging privilege exclusively, shall run for a period of not to exceed ten years, and shall not interfere with the free passage over the area under concession of boats or vessels, nor in any way prevent the unrestricted fishing, by other persons over the said area, for marine forms other than sponges: *Provided, however,* That, subject to confirmation by the Secretary of the Interior, the Director of Education or his authorized representatives may select from any concession, without charge, adequate areas of foreshore and waters for the cultivation of sponges or other marine forms for the purpose of any government school or schools located on or adjacent to any concession.

SEC. 5. The Collector of Internal Revenue shall collect the fees and charges fixed by virtue of the provisions of this Act. The annual con-

cession fees shall be due on the first of January of each year and, if tendered in quarterly installments, on or before the twentieth of January, April, July, and October, or on or before the last days of said months in remote provinces, in the discretion of the Collector of Internal Revenue, shall be received without penalty; but any person first beginning to fish, collect, or gather sponges under a concession, shall pay the first quarterly installment before his concession shall be valid. If the fee due on any concession is not paid within the period in which the payment may be received without penalty, the amount of same shall be increased by ten per centum, the increment to be a part of the fee. Should the concession fee remain delinquent fifty days after the same becomes due, the concession shall be canceled, without prejudice to criminal proceedings against the delinquent concessionaire under section twelve hereof.

Of the sums collected under and by virtue of this Act, twenty per centum shall accrue to the Insular Treasury and forty per centum to the province and municipality, respectively, in which the concession is located. In case a concession should be included within two or more provinces or municipalities, the distribution between the different provinces and municipalities shall be made in proportion to the areas of the concession included within the respective municipalities and provinces as aforesaid.

SEC. 6. A temporary written permit to prospect for sponges in any waters of the Philippine Islands, not under concession, may be granted by any provincial treasurer with the concurrence of and countersigned by the provincial governor, upon payment of a fee of five pesos. This temporary prospector's permit shall not be valid for a longer period of time than three months from date it is issued, and shall not be subject to renewal. Such permit may be issued to any person or corporation subject to the provisions of section two hereof.

Under no circumstances shall more than fifty kilos of cleaned sponges be gathered under such temporary permit. Should any such temporary prospector's permits be found with defaced, erased, or illegible date of issue, they shall be taken up at once by the first peace officer who becomes aware of this fact. At the end of the period for which these temporary prospector's permits are issued, they shall be returned to the issuing treasurers, who shall keep the same on file marked "canceled."

SEC. 7. Holders of a sponge concession shall have the privilege of erecting the necessary plant for the development and exploitation of the sponge industry such as houses, drying racks, corrals, landings, etc., on the shore convenient to the concession for the proper curing of sponges: *Provided, however,* That the previous approval of the Secretary of Commerce and Police should be had in accordance with the provisions of Act Numbered Sixteen hundred and fifty-four before erecting structures herein referred to.

SEC. 8. All sponges shipped from the Philippine Islands shall be graded as to variety and size and such grades must be placed in separate sacks and truthfully marked. It shall be the duty of the Insular Collector of Customs to enforce the provisions of this section in accordance with rules and regulations issued under this Act.

SEC. 9. Under penalty of the forfeiture of the concession and confiscation by the Government of the entire shipment in which found, no commercial sponge of less than ten centimeters through any diameter shall be taken from the waters of the Philippine Islands except for purposes of

sponge culture within Philippine waters. This penalty shall be imposed by the Secretary of the Interior after such investigation as he may deem necessary in each case, without prejudice to any punishment that may be imposed by the Court in accordance with the provisions of section twelve of this Act.

SEC. 10. The Secretary of the Interior is hereby authorized and empowered to make and prescribe, and from time to time to change, such rules and regulations as may be required to carry out the provisions of this Act, other than those fixing the manner for the collection of the fees and charges prescribed hereunder, and otherwise to conserve and promote the sponge industry in the Philippine Islands. Such rules and regulations when approved by the Governor-General shall have the force of law and any violation thereof shall be punished in accordance with the provisions of this Act.

SEC. 11. It is hereby prohibited and declared unlawful:

(*a*) To transfer any concession or permit granted or issued under the provisions of this Act, except with the consent of the Secretary of the Interior.

(*b*) To fish, collect, or gather any sponges growing on the sea bottom or reefs within the boundary of a concession occupied by another person, and granted under the provisions of this Act, or by a concessionaire outside the boundary of his concession.

(*c*) To engage in the practice of "loading" or impregnating sponges with foreign substance of any sort or character whatsoever for the purpose of increasing the apparent weight of said sponges and thereby deceiving purchasers of said sponges as to their true weight.

(*d*) To ship from or attempt to ship from the Philippine Islands any sponges taken from the waters thereof except through the Customhouse at one of the ports of entry of the Philippine Islands.

(*e*) To possess Philippine commercial sponges, unless holding a concession or permit in accordance with this Act or a bill of sale traceable from a concessionaire.

(*f*) To remove, deface, destroy, or in any way interfere with the location marks of any concession granted under the provisions of this Act.

(*g*) To possess undersized sponges, or sponges less than ten centimeters through any diameter.

(*h*) To take from the waters of the Philippine Islands any commercial sponge by the use of any dredge or "gáangara" except in waters of more than thirty fathoms in depth.

SEC. 12. Any person violating the provisions of this Act or any regulations issued by the Secretary of the Interior as provided for in this Act shall be punished by a fine of not less than twenty pesos and not more than five hundred pesos for each offense, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

In case any association or corporation shall violate or cause to be violated any provision of this Act, such association or corporation, upon conviction thereof, shall be punished by a fine of not less than one hundred pesos and not more than one thousand pesos for each offense, and any person, member, or employee of any association or corporation who shall violate or cause to be violated any provision of this Act, or shall aid, abet, or assist in such violation, or shall voluntarily permit the same, upon

conviction thereof, shall be punished by a fine not exceeding five hundred pesos for each offense, or by imprisonment not exceeding six months, or by both fine and imprisonment, in the discretion of the court.

SEC. 13. Violations of this Act may be prosecuted in any Court of First Instance of any province, but the court first lawfully taking cognizance thereof shall have jurisdiction of the same to the exclusion of all other courts.

SEC. 14. The Governor-General may, by executive order, designate the Governor of the Department of Mindanao and Sulu to perform the duties and powers devolving upon the Secretary of the Interior under this Act within the territorial limits of said Department.

SEC. 15. Act Numbered Two hundred nine of the former Legislative Council, entitled "An Act for the preservation and regulation of the sponge fisheries of the Moro Province, and for other purposes," is hereby repealed: *Provided, however,* That nothing in this Act provided shall be construed to impair any right or obligation acquired or imposed under the provisions of said Act numbered Two hundred nine for sponge concessions existing at the time of the passage of this Act

All records carried by the Government of the Department of Mindanao and Sulu under the provisions of said Act Numbered Two hundred nine are hereby transferred to the office of the Secretary of the Interior.

SEC. 16. The provisions of this Act shall not apply to persons gathering sponges outside of the limits of the concessions, provided the daily amount of sponges gathered by them does not exceed five kilograms.

SEC. 17. This Act shall take effect on its passage.

Enacted, February 4, 1916.

TORTOISE SHELL FISHERIES

Amount and value of the shell.—During 1914, 2,296 kilograms of tortoise shell, valued at 34,947 pesos, were exported from the Department of Mindanao and Sulu. The value of the shell depends largely upon the marking and ranges from 4 pesos per kilogram for the small shell to 167 pesos per kilogram for the first grade. It is sold by the catty, which is about equal to 1.4 pounds or 0.63 kilogram. The style in tortoise shell changes frequently; just now dark shell with but few spots is preferred.

Kinds of sea turtles.—There are three species of sea turtles that are of considerable commercial importance in the Philippines. These are the hawksbill, the loggerhead, and the green turtle. The hawksbill produces the thick tortoise shell of commerce. This turtle has a hooked bill, and its back is made up of 13 larger plates, which overlap each other, and 25 smaller plates, which form the margin. The loggerhead turtle also has a hooked bill, but is distinguished by having 15 plates on the back and 27 around the margin. The flesh is usually tainted with a fishy odor. The green turtle has a straight bill, and the plates

of the back are smooth and do not overlap. The green turtle is valued chiefly as food, the shell being thin and of no use except for veneer. Green turtles are very common, easily domesticated, and form a valuable food supply. In Spain an industry of importance consists of canning the meat and soup of the green turtle. Such an industry would be possible in Mindanao.

Breeding places and habits of the sea turtles.—The small outlying islands of the Sulu Archipelago, such as Bancoran, Lumbucan, the Pearl Banks, and several islets near Sibutu, are famous turtle resorts. The turtles come ashore on the sandy beaches to deposit their eggs. At this time they are captured by the turtle hunters. On one small sandy islet I counted twenty-four heads of turtles that had been recently killed.

The food of the hawksbill turtle consists almost exclusively of crabs, shrimps, and mollusks. A specimen that I kept in captivity for one year would not eat fish, dead or alive, under any condition. The green turtle will eat fish to a limited extent, but seems to prefer shellfish and sea weeds. The loggerhead lives exclusively on fish.

The sea turtles thrive in captivity with but little attention. Many of the inclosed lagoons of the Sulu Sea would make ideal turtle farms. Some of the Moros in the vicinity of Siasi and South Ubian capture young turtles and confine them in corrals or in pens until they are adult. This plan could be easily enlarged upon by closing the entrance of a small lagoon, thus forming a turtle farm similar to the famous one on Ascension Island.

Uses for tortoise shell.—The manufacturing of combs, jewel boxes, brush backs, and various ornaments from tortoise shell is an established industry in almost every civilized country. About 8,000 kilograms of tortoise shell valued at 100,000 pesos are gathered in the Philippine Islands each year. A manufacturing establishment to use this supply of shell could be located at Zamboanga or Jolo. Such a factory would require but little capital, probably not over 5,000 pesos. The manufactured articles would have free entry into the United States, thus avoiding the 50 per cent duty.

At the present time practically all Philippine tortoise shell is shipped to Japan, where it is manufacture into combs and other articles, which pay 50 per cent duty into the United States and are sold at a profit.

If private capital is not forthcoming for this work, it might be desirable to send an intelligent student to Japan to work in a tortoise-shell factory and learn the business.

COMMERCIAL CORALS

The most abundant coral in the Archipelago is the common *Porites,* or massive reef-building coral, that forms the greater portion of all reefs. Large blocks of this are sometimes used for building purposes; it is also used in road making and is frequently burned for lime.

Several other genera produce coral used for ornamental purposes, but this has little commercial value. Some of these are *Prodobacia,* which usually grows in the shape of a vase; *Herpetolitha,* which resembles a pickle dish; *Madrepora,* which grows like a great mushroom with its head covered with a crown of spikes; *Caeloria,* the brain coral; *Heliopora,* the blue coral; and *Tubipora,* the beautiful red organ-pipe coral. Two or three small pieces of the precious red coral have been found in this Archipelago, but no systematic search for the bed has ever been made.

The most valuable coral found in these waters is the black coral, *Antipathes abies.* This occurs in two forms; one, called *hay ten* by the Chinese, resembles a coiled wire and is unbranched, the other, called *thie chew* by the Chinese, is branched and when first taken from the water resembles a Christmas tree. It takes a beautiful polish and can be easily straightened by the use of dry heat.

The black coral is found in great abundance directly in front of the town of Jolo in Jolo Channel. It is also found in many other places, especially near Siasi and Sitanki; the principal fishery, however, is at Jolo.

There is a small local market for this coral after it has been made into canes, swagger sticks, and bracelets. China, however, is the principal market. The coral is usually cut into proper lengths for bracelets; these are made into bundles, each containing two dozen pieces. These bundles sell for 5 pesos each. The long sticks, which can be used for canes, sell at the rate of about 24 pesos for thirty sticks. I believe a market for this black coral could be found in Japan or Europe. At present, the amount exported is unimportant.

TREPANG FISHERIES

LOCATION OF PRINCIPAL FISHERIES

There is scarcely a reef or an island in the entire Sulu Archipelago where trepang (bêche de mer) does not abound.

The chief fisheries, however, are in the vicinity of Jolo, Siasi, Bongao, and Sitanki, not because there is more trepang near

these islands, but because the Samals, or water Moros, who do most of the fishing, live near these places. There is more trepang in Davao Gulf than in any other place I have visited, but there is no trepang fishery at that place, because there are no fishermen who understand the gathering and preparing of trepang.

The revenues derived from the trepang fisheries could be considerably increased by the spread of a little information that would lead to the opening of additional fisheries and to the improving of the methods of preparation.

This information could be disseminated in the most practical manner through certain schools. The students could be easily taught to recognize, cure, and market the various grades, thus providing a small income for themselves and at the same time improving the quality of the prepared grades of trepang.

Trepang from the Philippine Islands is put on the market in the poorest condition and brings the lowest price of any trepang—almost a third lower than the price obtained for Celebes and Australian trepang, although the species are the same. The need for more careful preparation of this product is obvious.

LOCAL NAMES, VARIETIES, AND VALUES OF TREPANG

Trepang (Malay, *tripang*) is a commercial product consisting of the dried bodies of various species of echinoderms of the family Holothuriidæ. The name is also applied to the living animal. Trepang is widely known under the name bêche de mer. The English names for the animal are sea cucumber and cotton-spinner. The Moro name is *bot*. There are many other local names, such as *balat, balatan, balate namaco, hi sam,* and *munsang*.[2]

There are about sixteen principal varieties and forty-seven commercial grades in the Philippines. In color they range from white to black. Some are smooth; others are covered with prickles. In life their length is from 12.5 to 45 centimeters or more, but when dry they are seldom more than 20 centimeters in length and from 2.5 to 8 centimeters in diameter. When properly cured, they look like a bologna sausage and should be dry enough to "rattle like walnuts in a bag."

Each species of commercial trepang is divided into three grades: namely, large (*toa*), medium (*tiong*), and small (*liow*), with their corresponding values. Thus the three grades of the oh nyeow are *toa oh nyeow sam,* valued at 150 pesos per picul; *tiong oh nyeow sam,* valued at 100 pesos per picul; and *liow oh*

[2] A check list of Philippine holothurians will be found in *This Journal, Sec. D* (1911), 6, 312.

nyeow sam, valued at 75 pesos per picul. The following commercial varieties and grades are recognized by the merchants in Zamboanga and Jolo:

Oh nyeow sam (*Plate IV, fig. 1*).—Great black trepang, *bot uac* of the Zamboanga Moros. This is a large, comparatively smooth trepang, without prickles or teats. When dry, large specimens measure from 15 to 20 centimeters in length by about 7 centimeters in diameter. They are found on sandy bottoms near reefs in water 15 fathoms or less in depth. This is the most valuable of all Philippine trepang, selling for as much as 1.50 pesos for a single specimen.

Thang nyeow sam (*Plate IV, fig. 3*).—Sandy-bellied black trepang, *bot calang*. This trepang resembles the oh nyeow sam, but is easily distinguished by the fact that the belly is roughened as if covered with coarse black sand; the back is also more corrugated and the body more nearly oval than the oh nyeow sam. This species is found in shallow water near reefs throughout the Archipelago. It prefers a sandy bottom. The following prices are paid for this trepang: Large (*toa*), 90 pesos per picul; medium (*tiong*), 75 pesos per picul; and small (*liow*), 50 pesos per picul.

Buoy hwah sam (*Plate IV, fig. 2*).—Long-prickled trepang, *bot calang*. It is almost impossible to distinguish this form from the che sam, except that it is smaller and the prickles, which cover the entire body except the belly, are longer. The body when dry is black, the prickles are long, and there may be from three to five prickles from one base. The dry specimen is from 4 to 14 centimeters long. This ranks second in value among Philippine trepang, being worth as much as 1 peso a specimen. The following values are quoted for the different grades: Large, 120 pesos per picul; medium, 70 pesos per picul; small, 50 pesos per picul.

Gan sam (*Plate IV, fig. 4*).—Great teat trepang, or great oval brown trepang, *bot bato*. This is one of the commonest Philippine trepang. It is easily distinguished by the two rows of teats on each side of the body. The body wall of this species is very thick. The adults are from 11 to 18 centimeters in length. They live in water from 1 to 10 meters in depth and are most often found among scattered rocks on a sandy bottom. The animals of this variety are always split open, and cross sticks are inserted to facilitate the drying. The large size sells for 70 pesos per picul; medium, 50 pesos per picul; small, 35 pesos per picul.

Oe sam (*Plate IV, fig. 5*).—Great smooth black trepang, *bot*

longa, bot hunas. This is a rather common form of trepang throughout the Archipelago. It is black, and the skin is smooth, without teats or prickles. It is more pointed and oval than the oh nyeow sam, which it most nearly resembles. The length of the dried adult is from 5 to 11 centimeters. It is found in comparatively shallow water near the shore on a sandy bottom. In Manila this species is quoted as being the most desirable of all the trepang; the price paid, however, will scarcely bear this out. The large size is valued at 45 pesos per picul; medium, 30 pesos per picul; small, 18 pesos per picul.

Che sam (*Plate IV, fig. 7*).—Great prickle trepang, *moi whar che, bot ista.* This trepang closely resembles the buoy hwoh sam, but is considerably larger. It is uniform black when dry, and with the exception of the belly it is entirely covered with long prickles. This is a common form and is found in shallow water near reefs, usually on a sandy bottom. The adults, when dry, are from 6 to 19 centimeters long. In life this species is more or less pink. Its maximum length is about 46 centimeters. It is distinguished by the long prickles, which cover the back and sides and are frequently joined at the base, forming starlike rosettes with from three to five points. Only the most experienced traders can distinguish between this form and the expensive buoy huah sam; therefore trepang with the long black prickles is usually classed as che sam, the value of which is as follows: Large, 45 pesos per picul; medium, 30 pesos per picul; small, 20 pesos per picul.

Ang thoot sam (*Plate IV, fig. 6*).—Smooth red trepang, *bot bantawan.* This is a small, very smooth dull red trepang. It is from 3 to 10 centimeters long. It is very common in shallow water and commands the following prices: Large, 30 pesos per picul; medium, 20 pesos per picul; small, 15 pesos per picul.

Peh thoot sam (*Plate IV, fig. 18*).—White trepang. While this form is of little value, it is important because of its abundance. It lives in shallow water and is gathered by men wading along the reef. It is from 3 to 9 centimeters long and uniform white when dry. Its value is from 7 to 18 pesos per picul.

Twa bing thoot sam (*Plate IV, fig. 15*).—Brown and white trepang. This trepang is found in very shallow water along the reef. It is of medium size—from 3 to 11 centimeters long—and is valued at from 10 to 20 pesos per picul.

Bing thoot sam (*Plate IV, fig. 16*).—Red and white trepang. This small trepang is rather smooth with a slight trace of red; its length is from 2 to 9 centimeters. It is found in shallow water. Its value is from 7 to 14 pesos per picul.

Bah sam, or che bah sam (*Plate IV, fig. 8*).—The convoluted trepang, *bot gamat.* This form is light brown, of moderate size, and greatly convoluted when dry. It is found in shallow water and is of comparatively little value, being worth only from 10 to 12 pesos per picul.

Choo bah sam (*Plate IV, fig. 12*).—Also called bot gamat. This is a third-class trepang with the skin considerably roughened with spicules. It is of medium size, light brown below, darker above, and is valued at from 7 to 16 pesos per picul, depending chiefly upon the size.

An tiow sam (*Plate IV, fig. 11*).—This is a name often applied to all of the third-grade trepang and includes a number of species. The name, however, is more properly applied to the rough, spiculate brown trepang shown in figs. 10 and 12. This species is very common and is often used to adulterate the shipments of better grades of trepang. Its value is from 8 to 9 pesos per picul.

Thoot sam (*Plate IV, fig. 13*).—The skin of the thoot sam is white and is covered with numerous chalky spicules. It is a common shallow-water trepang of the third class and is valued at about 10 pesos per picul.

Thoot ah sam (*Plate IV, fig. 14*).—This is a very small trepang; it is dark or brown above and white below. It is common on almost all reefs in the Sulu Sea and is valued at 8 pesos per picul.

Thang sam (*Plate IV, fig. 9*).—*Bot jadish.* This is a long black trepang, of little value because of its thin body walls. It is used chiefly to adulterate shipments of better grades. It is a very common shallow-water form, valued at from 6 to 10 pesos per picul.

METHODS OF PREPARING TREPANG

Trepang are gathered at low tide. The fisherman usually walks along the reef, carrying a single-pronged spear with which he transfixes the animals. In deeper water it is necessary to dive for them. The best grades are usually in water from 3.5 to 6 meters deep or even deeper. In some places small dredges could be operated with advantage.

After the trepang are gathered, they are taken to the curing station and cared for promptly; otherwise they become a blubbery, unsavory mess within a few hours. They are first placed in a pot or caldron of water (an oil tin would answer the purpose) and boiled for twenty minutes (some require less time). When taken out of the boiling water, they should be hard and elastic

and should dry quickly like a hard-boiled egg. They are slit open with a sharp-pointed knife, and the entrails are removed.[3] They are next placed in the sun and left until almost dry and then transferred to a smoke house [4] and smoked for about twenty-four hours. The smoked trepang are spread on a mat in the sun until perfectly dry. Finally they are packed in bags. Trepang are prone to collect moisture, and if kept for three or four weeks they must be again spread out and dried in the sun to prevent molding. I found that if a small amount of sulphur was burned in the smoke house a short time before the smoking process was finished it prevented this mold from making its appearance for a long time. However, we have yet to learn if the slight sulphur flavor would affect the price.

Numerous complaints have been received from Hongkong and Singapore dealers that the Philippine trepang was not well prepared and that it was for the most part a third-grade product, which brought a third-grade price. The remedy for this lies in following the instructions given above and in securing more of the better varieties of trepang. The Moros do not exercise enough care in curing this product, and as the better varieties are in deep water and more difficult to collect, they are content to gather such trepang as come easily to hand. The Moros cure the trepang by drying and smoking it on a stick thrust through the body of the animal. When scarcely more than half cured, it is offered for sale.

A wholesome soup can be prepared from trepang as follows: Clean, wash, and mince fine; soak in cold water five hours; boil for one hour; add salt, pepper, butter, and some beef or chicken stock. Serve hot or iced.

HABITS AND FOOD OF TREPANG AND THE POSSIBILITIES OF CULTIVATING THEM

Trepang are very sedentary animals, moving very slowly and for but short distances. Some species prefer the lagoons of coral reefs, others live on the sandy bottom just outside the reef, while a few kinds are found only in deep water. The food of the trepang consists of small larvæ and animals, chiefly Foraminifera, or of sea plants, which it abstracts from the prodigious quantity of sand that passes through its alimentary canal. Some species secure in this manner great quantities of

[3] Small trepang are seldom gutted in the Philippines.

[4] A packing box, a barrel, or a smoke house made with mat sides will answer the purpose. The trepang must be placed at a distance from the fire, which should never burn brightly but simply smoulder.

larval Crustacea. The tufted arms, or tentacles, are constantly gathering food, which is thrust into the mouth of the animal.

The animal becomes of adult size in two years. It spawns in its third year. Some specimens, which I believed to be but two years old, contained many eggs. The young animals are white and transparent. They attach themselves to roots of sea plants or seek the safety of rocky crevices. I have found quantities of the young under rocks near shore.

The Japanese make use of this habit of the young in their sea farming by placing convenient rock piles in shallow water in order to attract the young. Japan has also set aside certain localities as breeding reserves for trepang, and in this way they conserve this valued sea product.

Considering that certain of these trepang are valued at more than 1.50 pesos each, that they can be grown on a comparatively restricted area of the reef, and that they are ready for the market in two years, it is rather surprising that no work on the cultivation of some of the best varieties has been undertaken. The trepang exported from the Department of Mindanao and Sulu during 1913 weighed 90,786 kilograms, valued at 35,107 pesos. During the first four months of 1914 there were exported 48,502 kilograms, valued at 15,626 pesos. This amount could be at least doubled by a little systematic work.

Australia exports trepang valued at 300,000 pesos each year. Japan consumes a large part of her own supply and exports 90,000 pesos' worth of trepang. The Philippine Islands, which occupy the most favorable position and have hundreds of miles of reef with an abundance of trepang, fall far below either Australia or Japan in their production of prepared trepang. There is an opportunity for canning and packing companies to enter this field and to supply trepang soup to the unlimited market of China.

ILLUSTRATIONS

Plate I

Map, showing the location of sponge beds of Mindanao and Sulu. (Drawn in the Bureau of Science from Coast and Geodetic Survey charts 4200 and 4722.)

Plate II. Philippine Sponges

Fig. 1. Elephant's-ear sponge.
2. Sulu Sea bath sponge.
3. Honeycomb sponge.
4. Sheep's-wool sponge.
5. Philippine zimocca sponge.
6. Grass sponge.

Plate III. Three Species of Philippine Turtles

Fig. 1. Head of the loggerhead turtle (*Thalassochelys caretta* Linn.).
2. Carapace of the loggerhead turtle.
3. Head of the hawksbill turtle (*Chelone imbricata* Linn.).
4. Carapace of the hawksbill turtle.
5. Head of the green turtle (*Chelone mydas* Linn.).
6. Carapace of the green turtle.

Plate IV. Philippine Commercial Trepang

Fig. 1. Oh nyeow sam; great black trepang.
2. Buoy hwah sam; long-prickled trepang.
3. Thang nyeow sam; sandy-bellied black trepang.
4. Gan sam; great teat trepang, or oval brown trepang.
5. Oe sam; great smooth black trepang.
6. Ang thoot sam; smooth red trepang.
7. Che sam, or moi whar che; great prickled trepang.
8. Bah sam, or che bah sam; convoluted trepang.
9. Thang sam; long black trepang.
10. Choo bah sam; brown trepang.
11. An tiow sam; spiculated trepang.
12. Choo bah sam; brown trepang.
13. Thoot sam; white spiculated trepang.
14. Thoot ah sam; common trepang.
15. Twa bing thoot sam; brown and white trepang.
16. Bing thoot sam; red and white trepang.
17. Liow thoot ah sam; yellow and brown trepang.
18. Peh thoot sam; white trepang.

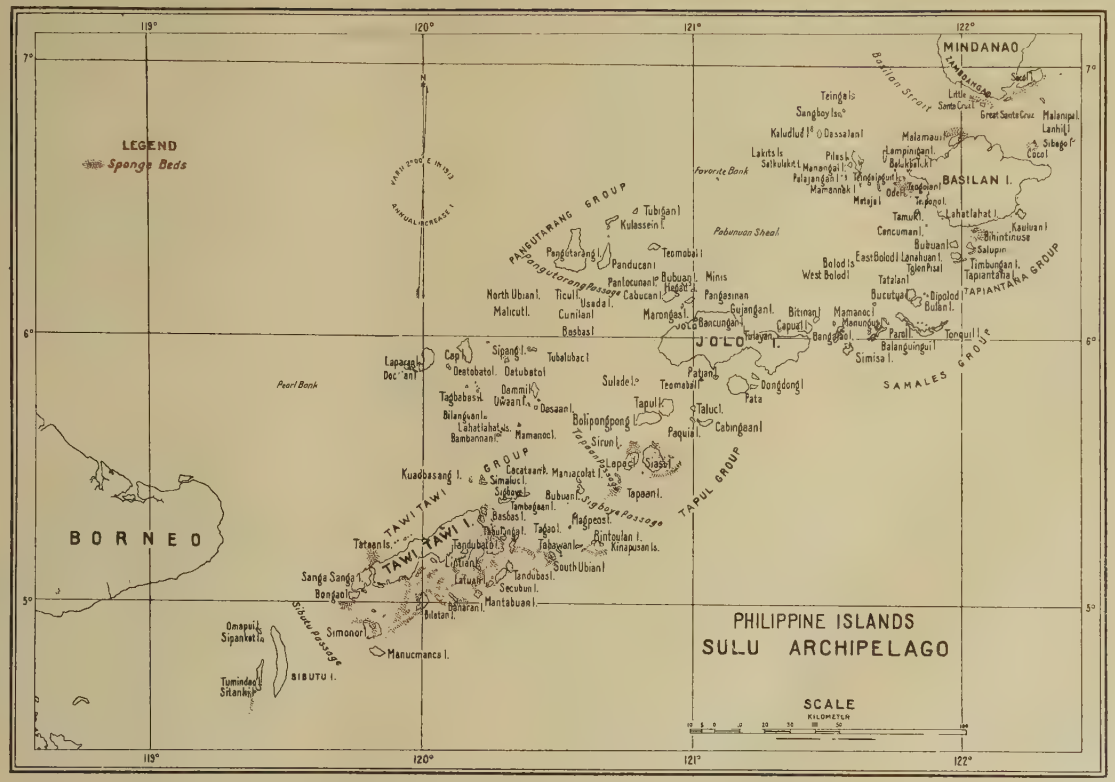

PLATE I. THE SPONGE BEDS OF MINDANAO AND SULU.

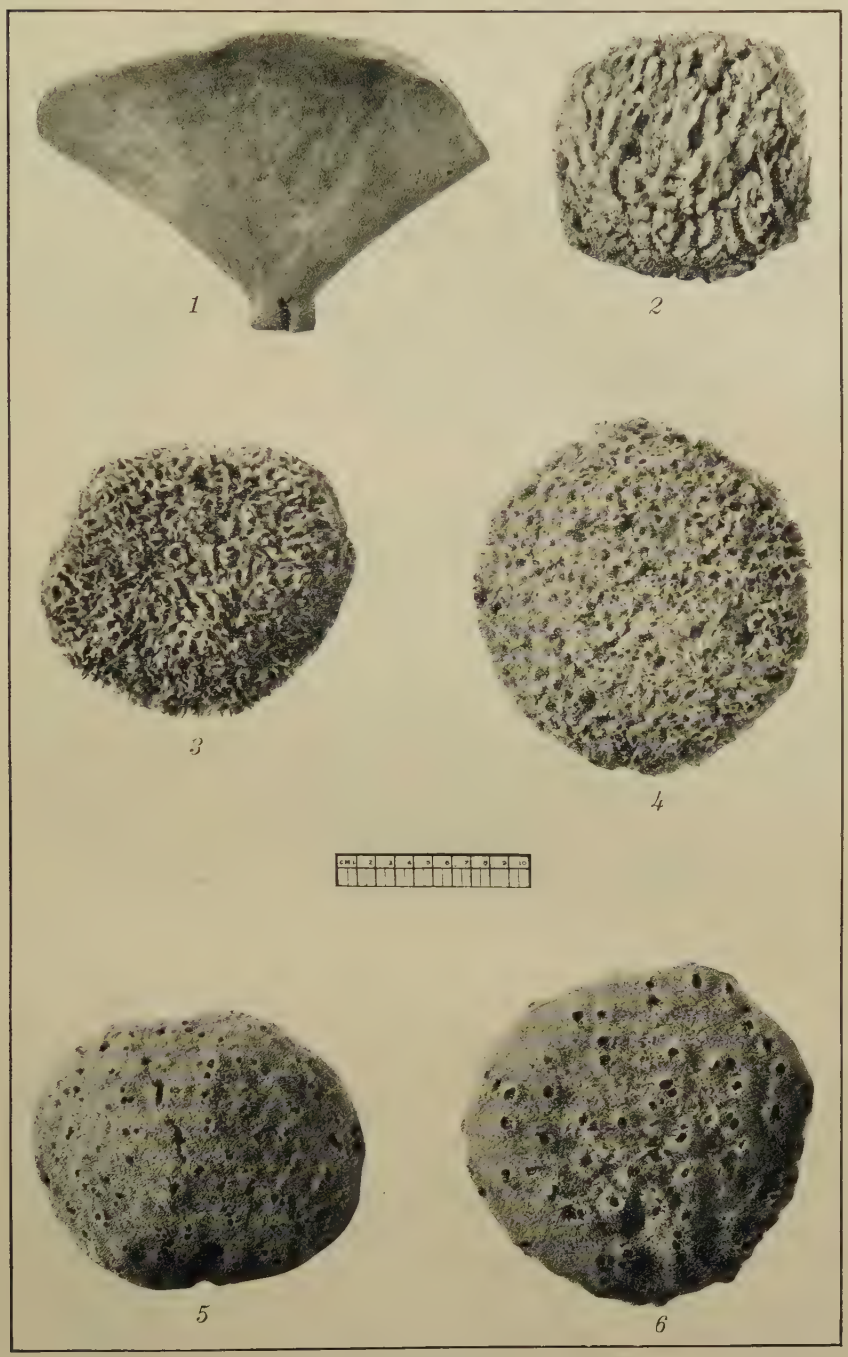

Fig. 1. Elephant's-ear sponge. 2. Sulu Sea bath sponge. 3. Honeycomb sponge. 4. Sheep's-wool sponge. 5. Philippine zimocca sponge. 6. Grass sponge.

PLATE II.

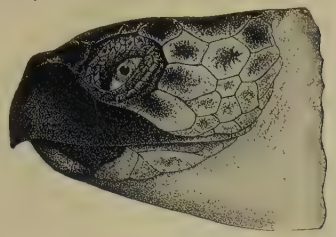

Fig. 1.

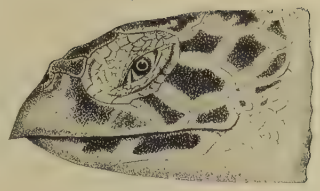

Fig. 3.

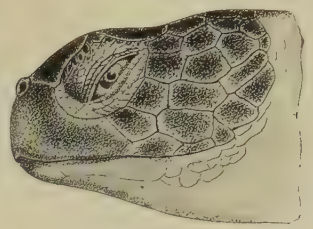

Fig. 5.

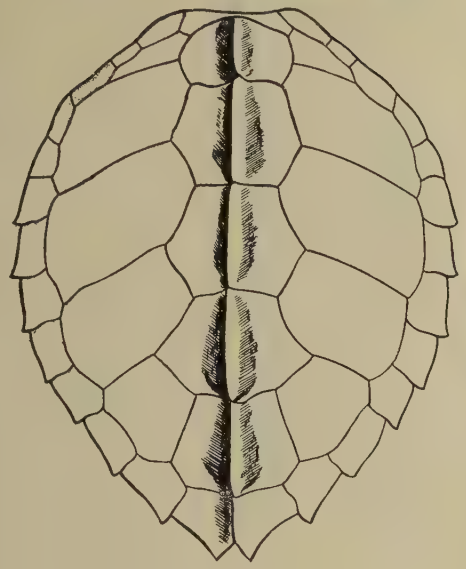

Fig. 2.

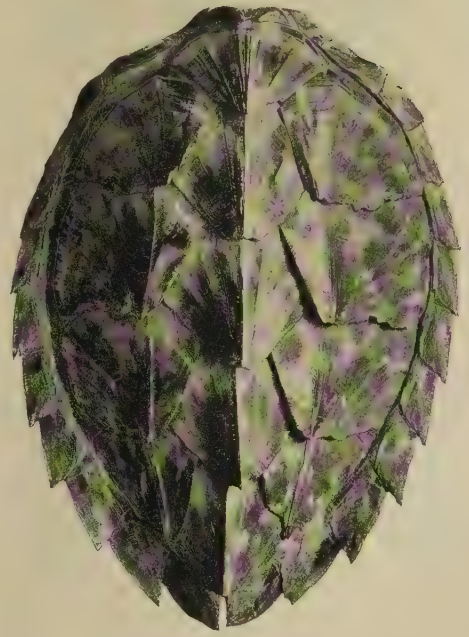

Fig. 4.

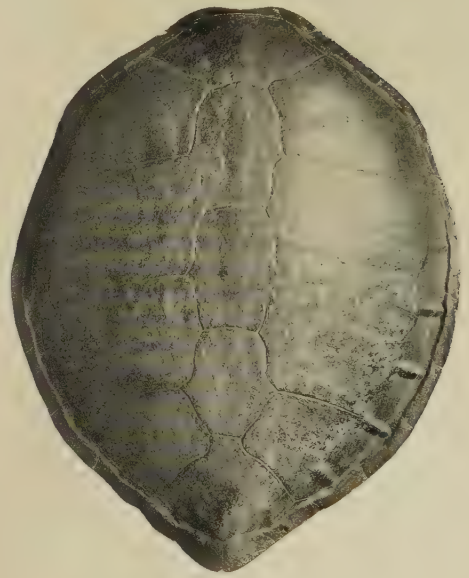

Fig. 6.

PLATE III. THREE SPECIES OF PHILIPPINE TURTLES.

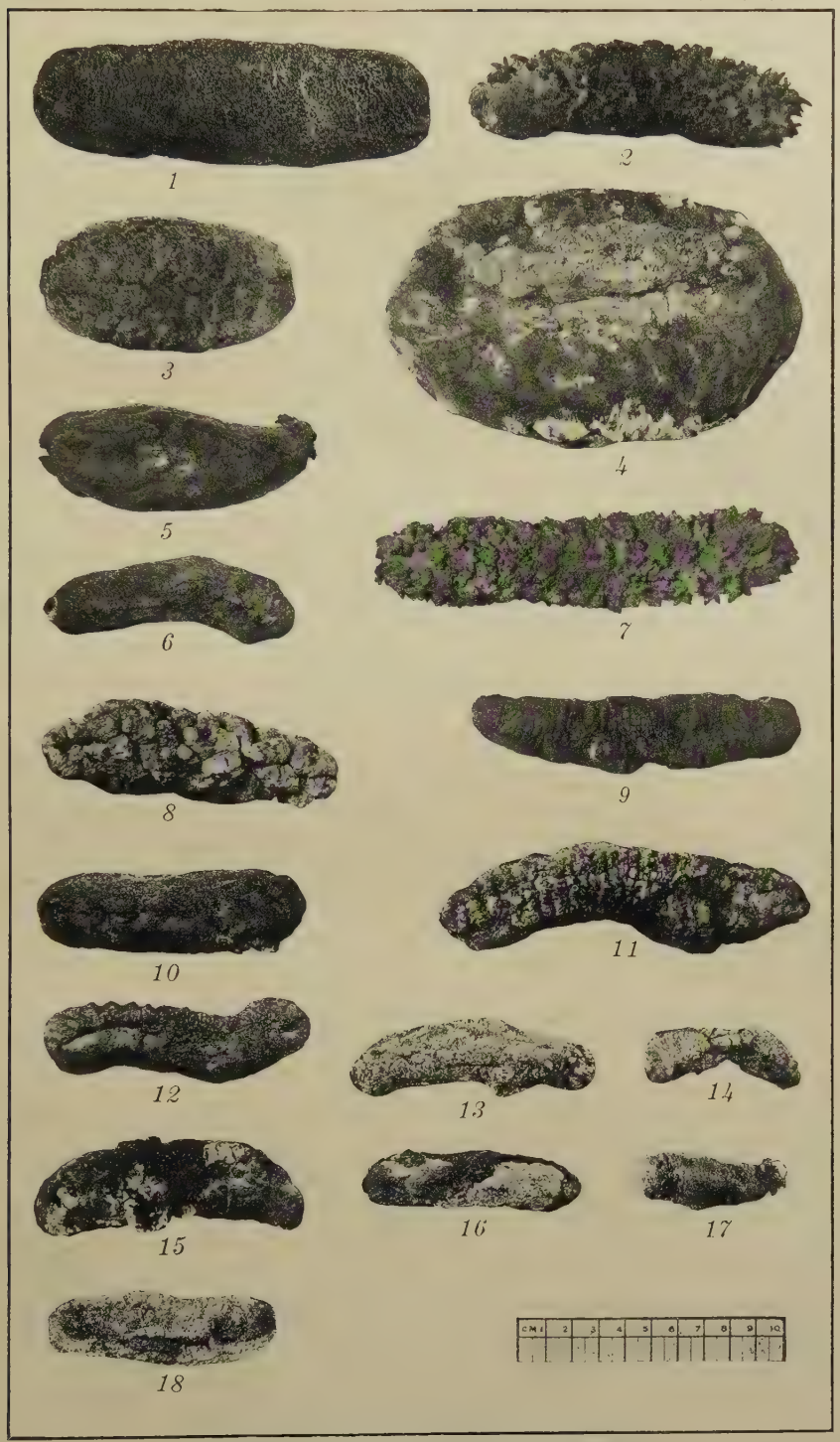

PLATE IV. PHILIPPINE COMMERCIAL TREPANG.

A PHILIPPINE APHRASTOBRACON

By C. F. Baker
(*From the College of Agriculture, University of the Philippines*)

In 1896 [1] W. H. Ashmead described a very remarkable hymenopterous parasite of the family Braconidæ, from Ceylon, under the name *Aphrastobracon flavipennis*. It had been bred by Mr. E. E. Green from a culture of a lac insect, *Tachardia albizziæ*, but probably came from a lepidopterous insect feeding on the *Tachardia*. In the structure of the head and the submedian cell in the wings it differed from all known members of this family, and as a consequence, Ashmead founded for it not only a new genus, but a new tribe in the subfamily Braconinæ. Briefly it is a cyclostomatous braconid with immargined occiput, having a linear face, greatly enlarged eyes but small ocelli, and the submedian cell much shorter than the median on the median vein.

Among the Rhogadinæ of the Philippine Islands there are several genera related to *Gyroneuron* of Kokujew, described [2] from Assam, all of which present remarkable venational characters, accompanied by other unique structural details. Had Ashmead known *Gyroneuron*, he would not have passed without remark certain very similar venational features in *Aphrastobracon*. On account of this unique venation, I had accidentally placed a fine Philippine representative of *Aphrastobracon* with the Rhogadinæ, from which, however, it is excluded by the immargined occiput. Even from Ashmead's very incomplete description it is apparent that the Philippine species is entirely distinct from *Aphrastobracon flavipennis*.

Aphrastobracon philippinensis sp. nov.

Thorax and legs pale ochraceous, abdomen sordid ochraceous; antennæ brownish black, paler apically. Wings faintly smoky, base of first cubital cell dark smoky, the costa above it black-spotted; veins pale ochraceous, paler on distal half of wing. Body clothed with whitish pubescence, heavier on legs, abdominal dorsum, and costa.

Male.—Head cubical, viewed from above with eyes little bulging

[1] *Proc. U. S. Nat. Mus.* (1895), 18, 646.
[2] *Rev. Russe Ent.* (1901), 1, 232.

beyond the head outline, but deeply entering the head, the distance between them at the ocelli about equaling the length of cheek margin behind eyes; vertex behind ocelli broadly convex, smooth and shining, the distance from ocelli to occipital margin being about twice the shortest distance between eyes; ocelli small, distance between the two posterior a little less than distance from them to eyes; anterior ocellus remote from the two others, separated from them by twice the distance between eyes and posterior ocelli; surface between ocelli and eyes with very shallow wrinkles.

Face very narrow at middle, the outline that of a dumb-bell, broadened above by the deeply emarginated eyes, the width at antennæ and at clypeal margin being nearly twice that at the middle; surface with a short, poorly defined median carina below antennæ, and throughout finely, obscurely, irregularly rugose; clypeus narrowly semilunate, the clypeal pits separated from the eyes by their own diameter; mouth opening subcircular.

Head as viewed from side with margin of face parallel to eye margin; malar space nearly obsolete; cheek about one fourth as wide as the greatest eye diameter, its outer margin parallel to eye margin; eye very large, short subelliptical, broadest on lower half; third and fourth joints of maxillary palpi long, subequal.

Mesonotum deeply trilobed, smooth and shining, the notauli deeply impressed anteriorly, noncrenulate, and running straight backward to lateral angles of scutellum; posteromedian area broadly, evenly, shallow depressed. Scutellum triangular, large, evenly convex, smooth and shining; anteriorly with a deeply impressed, straight-margined, transverse, crenulate groove. Metanotum smooth and shining; spiracle large, subcircular, raised on a slight prominence, the surface before it slightly depressed, beneath it a fine, slightly impressed, longitudinal furrow. Pleura smooth and shining, the mesopleura without discal impressions; a deep furrow separating pro- and mesopleura above.

Abdomen sessile, longer than head and thorax together, spindle-shaped, broadest at fourth segment, seven segments being fully exposed; first segment a half longer than wide at apex, the second, the third, and the fourth subequal in length and a little shorter than the first; the second as long as wide at apex, the remainder wider than long; midlateral areæ of first and second segments with broad, shallow, longitudinal impressions, these being parallel with outer margins of segments, and leaving subtriangular, median, raised areæ; there are rudiments of such

impressions at lateral bases of third and fourth segments; the impressions on first and second segments are centrally, minutely carinate, and those on second, third, and fourth are minutely, irregularly rugose within; remainder of surface of all tergites smooth and shining; first suture normal; second suture medially, deeply impressed and crenulate obsolete at sides; a crenulate transverse groove occurs some distance behind the normal third suture; fourth suture impressed and crenulate. Hind tibiæ with two stout, straight, pubescent spines, the inner a little the longer.

Wing surface very uneven by reason of several sharp folds in its membrane, one passing through median cell into second discoidal and another thence along cubitus. Stigma very large, broad, broadly rounded below, four times as long as wide, the radius inserted nearly at center. First abscissa of radius a little less than half the length of second; second cubital cell nearly three times as long as wide, a little narrowed apically, the first transverse cubital vein straight and very oblique, the second vertical and decolored; recurrent vein inserted near apex of first cubital cell, the intervening vein decolored; first abscissa of cubitus very strongly upcurved, making the first cubital cell very narrow. The transverse median vein is very oblique and is carried proximad to a distance before the basal vein equal to the apical width of median cell, the intervening portion of median vein and the postmedian vein greatly enlarged, the latter strongly curved; the second discoidal cell is thus of unusual size, twice as long as wide, long oval in outline, and broadly rounded apically; the parallel vein is interstitial, the juncture of the veins being greatly enlarged; the posterior vein, also, is unusually heavy.

Length, 7 millimeters.

LUZON, Laguna, Mount Maquiling (*Baker*).

This new species differs from *Aphrastobracon flavipennis* Ashmead in the greater size, scape two times as long as wide (three times in *flavipennis*); flagellar joints longer than wide ("wider than long" in *flavipennis*); face more coarsely sculptured ("finely shagreened" in *flavipennis*); and wings black-spotted at middle of fore margin (not so in *flavipennis*). Doubtless more fundamentally important differences will be recognized when *A. flavipennis* shall have been properly described.

A NEW GENUS OF DERBIDÆ FROM BORNEO

By Frederick Muir
(*Hawaiian Sugar Planters' Association, Honolulu, Hawaii*)

ONE TEXT FIGURE

Genus **MONOCHORHYNCHUS** novum

Head narrower than thorax; vertex quadrate, width of base greater than length, apex about half of base, base obtuse-angularly emarginate, carinæ along base and sides fading out toward apex, basal area depressed, rising to apex, elevation at base of face making apex look angular; face narrow, lateral carinæ nearly touching in middle, basal half with lateral carinæ small and a fine median suture except at base where face is subtumid, apical half of face with deep lateral carinæ; clypeus much longer than face, strongly tricarinate; rostrum as long as clypeus, reaching to beyond the middle of abdomen, last segment short, greatly enlarged at apex so that it forms a suckerlike pad; eyes reniform, not reaching beyond the middle of the face; antennæ about half the length of face, terete, second joint slightly diminishing at base, flagellum at apex. Pronotum deeply and angularly emarginate on hind margin; mesonotum longer than broad, lateral angles behind middle, tricarinate, the lateral carinæ being sutures with fine carinæ on the outer edge. Tegmina with six median sectors, the third furcate; cubitus with two veins with the first median sector approximate; clavus small, open.

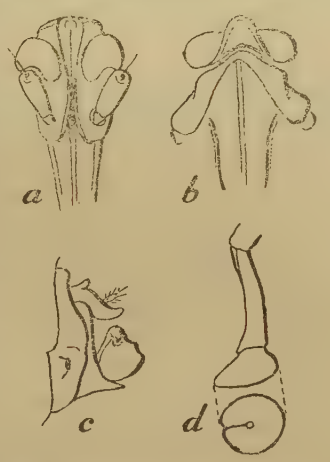

Fig. 1. *Monochorhynchus wahri* g. et sp. nov., *a*, face, front view; *b*, vertex and pronotum, dorsal view; *c*, genitalia, lateral view; *d*, rostrum, lateral view.

The tegmen in this genus is similar to that in *Paraprontista*, to which genus it is related, but the vertex, the face, and the apical joint of rostrum easily distinguish the two genera.

Type, *Monochorhynchus wahri* Muir.

Monochorhynchus wahri sp. nov.

Male.—Light brown, darker between carinæ of mesonotum, across lateral portions of pronotum, end of rostrum, and over abdominal tergites. Tegmina hyaline, slightly tinged with brown, clearer spots on basal half along costal and radial cells; wings half the length of tegmina, hyaline with brown veins.

Pygophor very short, ventral edge slightly and angularly produced to middle; anal segment longer than wide, anus near base, lateral margins gradually converging beyond anus to the rounded apex; genital style subquadrate, apex wider than base, dorsal edge with a small rim, dorsoapical corner forming a small, round knob with a small spine on it, apical edge with two small, strong spines on the inner margin.

Length, 4.3 millimeters; tegmen, 10.5.

Female unknown.

BORNEO (*J. E. A. Wahr*). Type, No. 13123, Bureau of Science collection.

ILLUSTRATION

TEXT FIGURE

FIG. 1. *Monochorhynchus wahri* g. et sp. nov., *a*, face, front view; *b*, vertex and pronotum, dorsal view; *c*, genitalia, lateral view; *d*, rostrum, lateral view.

NOTES ON A COLLECTION OF TERMITES FROM LUZON, OBTAINED BY R. C. MCGREGOR

By Masamitsu Oshima
(*Of the Government Institute of Science, Formosa*)

ONE TEXT FIGURE

In 1916 Mr. R. C. McGregor, of the Bureau of Science, Manila, made a small collection of termites in and near Manila, Luzon, which he very kindly forwarded to me for examination. In the present paper is given a record of this collection, with descriptions of three new species: namely, *Calotermes malatensis, Eutermes luzonensis,* and *Eutermes balintauacensis.*

Calotermes (Neotermes) malatensis sp. nov.

Imago.—Head reddish brown, pronotum, labial palpi, and antennæ somewhat paler; mesonotum, metanotum, and abdominal tergites yellowish brown; legs pale yellowish brown. Head sparingly pilose; long spiny hairs mingled with shorter ones on the pronotum; abdominal tergites beset with delicate hairs and provided with a series of long spiny hairs.

Head round; antennæ 19-jointed, second joint nearly as long as third, fourth joint shorter than third; eye large, prominent; ocellus in contact with eye; postclypeus indistinctly separated from forehead; anteclypeus trapezoidal, its anterior border nearly straight; labrum tongue-shaped, slightly longer than broad; pronotum quadrilateral, vaulted above, anterior border nearly straight, posterior border arcuate and slightly curved at middle, anterolateral corners depressed; mesonotum and metanotum narrower than pronotum, their posterior borders nearly straight; anterior wing stumps very much larger than the posterior, reaching beyond the middle of the latter; wings hyaline, veins yellowish brown; subcostal nerve of the anterior wing short, radius reaching to the basal third of costal margin, radius sector with six branches, median nerve runs near and parallel to the former, bending slightly at the base, cubitus reaches to tip of wing, with about ten branches, of which the proximal six are stronger; subcostal nerve absent in the posterior wing, radius reaching to the costal margin beyond the middle, radius sector with four

branches; median nerve starts from the middle of radius, cubitus with about nine branches.

	mm.
Length of body with wings	15.50
Length of body without wings	7.50–9.00
Length of anterior wing	11.00
Length of head	1.56
Width of head	1.50
Width of pronotum	1.78–1.87
Length of pronotum	1.09–1.18

Soldier.—Head reddish brown; anteclypeus yellow; antennæ reddish brown, paler anteriorly; mandibles blackish brown; pronotum pale yellow; mesonotum, metanotum, and abdomen straw-colored, the latter mottled with milky spots. Head sparingly pilose; sternites moderately pilose; on the abdominal tergites long spiny hairs mingled with shorter hairs.

Head cylindrical, sides slightly converging anteriorly, posterior border rounded; antennæ 15-jointed, second joint incurved, cone-shaped, and nearly as long as third, fourth and fifth joints subequal, much shorter than third; upper border of antennal fossa projecting laterally, overhanging the proximal joint of antennæ; rudimentary eye oval, situated behind the antennal fossa; no fontanelle; postclypeus not separated from forehead, a series of spiny hairs along its anterior border; anteclypeus quadrilateral, anterolateral corners rounded; labrum tongue-shaped, slightly broader than long, with a cluster of long hairs at the tip; mandibles stout, with piercing incurved tip, right mandible with two subequal, triangular teeth, left mandible with three teeth, the apical one pointed, the second and the third broad; pronotum quadrilateral and vaulted above, anterior border nearly straight, lateral borders convex, posterior border slightly curved at middle; mesonotum and metanotum much narrower than pronotum, with rounded posterior borders.

FIG. 1. *Calotermes malatensis* sp. nov., soldier's mandibles, *a*, left; *b*, right.

	mm.
Length of body	13.00
Length of head with mandible	5.33
Length of head without mandible	3.53
Width of head	2.33
Width of pronotum	2.61
Length of pronotum	1.56

Locality.—Luzon, Manila, Malate, October 15, 1916, from a decayed limb of a small tree, *Samanea saman* Merrill.

Coptotermes travians (Haviland).

Soldier.—Head yellow; mandibles brown; abdomen whitish. Head sparingly pilose; abdominal tergites densely provided with subequal hairs.

Head oval, slightly vaulted dorsally, sides converging anteriorly; fontanelle tube-shaped, large, its orifice directed forward, reaching beyond postclypeus; postclypeus very short; labrum triangular, tip hyaline, reaching to middle of mandibles; antennæ 14-jointed, third joint as long as second; submentum very weakly contracted at middle; pronotum slightly longer than half the width, anterior border distinctly indented at middle, posterior border weakly curved at middle.

	mm.
Length of body	4.50–5.00
Length of head with mandibles	1.97–2.03
Length of head without mandibles	1.34–1.40
Width of head	1.09
Width of pronotum	0.71–0.81
Length of pronotum	0.40–0.43

Locality.—Luzon, Manila, Malate, July, 1916, from tunnels in a telephone pole. Imago and worker were not collected.

Remarks.—The present species is here recorded for the first time from the Philippine Islands.

Termes (Macrotermes) philippinensis Oshima.

Soldier (the larger form).—

	mm.
Length of body	9.00–9.50
Length of head with mandibles	4.63–5.00
Length of head without mandibles	3.33–3.53
Width of head	2.53–2.80
Width of pronotum	2.20–2.33
Length of pronotum	1.20–1.33

Soldier (the smaller form).—

	mm.
Length of body	5.00
Length of head with mandibles	3.49
Length of head without mandibles	2.03
Width of head	1.53
Width of pronotum	1.31
Length of pronotum	0.62

Locality.—Luzon, Manila, Malate, May, 1910.

Eutermes (Hospitalitermes) luzonensis sp. nov.

Eutermes (Hospitalitermes) hospitalis OSHIMA, Phil. Journ. Sci., Sec. D (1916), 11, 360, Pl. II, figs. 12–14.

Soldier.—

	mm.
Length of body	3.00–3.50
Length of head with rostrum	1.71–1.74
Length of head without rostrum	1.25–1.28
Width of head	1.00–1.03
Width of pronotum	0.56–0.59

Locality.—Luzon, Balintauac, near Manila, August 6, 1916.

Remarks.—In my previous paper I identified the present species with *Eutermes hospitalis* Haviland. However, after close examination of a vast number of specimens I have recently come to the conclusion that it is reasonable to separate the two. There are two forms of worker in *Eutermes luzonensis*, instead of one as in the other, and the soldier's head is much smaller.

Eutermes (Eutermes) balintauacensis sp. nov.

Imago.—Unknown.

Soldier.—Head yellow, tip of rostrum becoming yellowish brown; antennæ yellow; thorax and abdomen yellowish white; legs straw-colored. Head very sparingly pilose; sternites smooth; abdominal tergites densely beset with microscopically minute hairs.

Head ovoid, with slender conical rostrum, upper surface slightly incurved at junction of rostrum; antennæ 12-jointed, third joint the smallest, second joint longer than third, fourth joint slightly longer than second; pronotum saddle-shaped, anterior border rounded.

	mm.
Length of body	3.00–3.20
Length of head with rostrum	1.34–1.43
Length of head without rostrum	0.74–0.81
Width of head	0.81–0.84
Width of pronotum	0.37–0.40

Worker.—Head yellow, Y-sutures distinct, whitish; thorax and abdomen white. Head sparingly pilose; abdominal tergites densely provided with delicate hairs.

Head round; postclypeus swollen, less than half as long as broad; antennæ 13-jointed, second joint slightly shorter than fourth, third joint the smallest and shorter than second; pronotum saddle-shaped, anterior border indented at middle.

	mm.
Length of body	3.50
Width of head	0.93
Width of pronotum	0.50

Locality.—Luzon, Balintauac, near Manila, August 6, 1916, from a covered tunnel on a small tree, *Caesalpinia sappan* Linn.

Remarks.—The present species is closely allied to *Eutermes minutus* Oshima. However, it differs from the latter in having a shorter and narrower head in the soldier.

Eutermes minutus Oshima.

Locality.—Luzon, Rizal Province, Las Piñas, near Manila, August 27, 1916; from the inside of an old log.

Microcerotermes los-banosensis Oshima.

Locality.—Luzon, Manila, Malate, July 30, 1916, from a fence post.

ILLUSTRATION

TEXT FIGURE

FIG. 1. *Calotermes* (*Neotermes*) *malatensis* sp. nov., soldier's mandibles, *a*, left; *b*, right.

NOTES ON JAPANESE LEPIDOPTERA AND THEIR LARVÆ: PART IV [1]

By A. E. Wileman
(*London, England*)

TWO COLORED PLATES

HETEROCERA

AGARISTIDÆ

Genus CHELONOMORPHA Motschulsky

Chelonomorpha Motschulsky, Etud. d'Ent. (1860), 9, 30.

Chelonomorpha japona Motschulsky.

Plate I, fig. 1, larva; fig. 2, food plant.

Japanese name, *toraga*.[2]

Chelonomorpha japona Motschulsky, Etud. d'Ent. (1860), 30; Leech, Trans. Ent. Soc. London (1899), 212, No. 681; Hampson, Cat. Lep. Phal. (1901), 3, 529; Matsumura, Cat. Insect. Jap. (1905), 1, 112, No. 969; Kirby, Cat. Het. (1892), 30; Jordan, Seitz's Macrolep. Faun. Pal. (1906), 3, 6, Pl. I *b;* Matsumura, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1910), suppl. 2, 69, Pl. 23, fig. 1, ♂.

Eusemia villicoides Butler, Ann. & Mag. Nat. Hist. (1875), IV, 15, 141, Pl. 13, fig. 2 (=*japona* Motsch.).

Eusemia japana Leech, Proc. Zool. Soc. London (1888), 613, No. 163.

Chelonomorpha austeni Moore, Lep. Atk. (1879), 11; Hampson, Moths India (1894), 2, 154; Cat. Lep. Phal. (1901), 3, 529, fig. 231, ♀; Jordan, Seitz's Macrolep. Faun. Pal. (1906), 3, 6, Pl. I *b*.

The larva figured (Plate I, fig. 1) was taken in September (figured September 15), 1902, at Hakodate, Oshima Province, Hokkaido, on *shiode* (*Smilax herbacea* Linn. var. *nipponica* Maxim.), and I bred a female imago from it July 7, 1903.

[1] The first paper of this series was printed in *This Journal, Sec. D* (1914), 9, 247–268, 3 pls.; Part II, in (1915), 10, 281–306, 3 pls.; Part III, in (1915), 10, 345–364, 3 pls.

[2] In his Catalogus Insectorum Japonicum [sic] (1905), 112, Matsumura gives the Japanese name of *toraga* to *Mimeusemia persimilis* Butl., and in his Nihon Senchu Dzukai (1910), 69, he gives the same name to *Chelonomorpha japona* Motsch.

The following description is taken from my original figure:

Larva.—Bluish white, marked with many irregular black spots and dashes; head black; legs, prolegs, and claspers black; segment 2 (head counting as segment 1) orange with transverse series of small black spots; segment 12 dorsally orange with four black spots; anal shield black; a faint suprapedal orange stripe from segment 3 to 12, more conspicuous over prolegs on segments 7, 8, 9, and 10.

Local distribution.—Hokkaido (Yezo): Hakodate, Oshima Province, May, July (*Leech, Wileman*). Honshu: Nikko, Shimotsuke Province, July (*Wileman*).

Chelonomorpha japona seems to be a mountain species, as I have never met with it in the plains except in Hokkaido. Matsumura records it from Hokkaido and Honshu.

Time of appearance.—Larva, September; imago, June and July.

General distribution.—Central and northern Japan in June and July; western and central China; northern India (*Hampson, Jordan*).

ARCTIIDÆ

NOLINÆ

Genus ROESELIA Hübner

Roeselia HÜBNER, Verz. (1827), 397.

Roeselia mandschuriana Oberthür.

Plate I, fig. 3, larva; fig. 4, food plant; fig. 5, head and dorsal process. Japanese name, Hakodate, *kobuga.*[3]

Erastria mandschuriana OBERTHÜR, Etud. d'Ent. (1880), 5, 83, Pl. 2, fig. 9; KIRBY, Cat. Het. (1892), 371; BUTLER, Ann. & Mag. Nat. Hist. (1881), V, 7, 236; LEECH, Proc. Zool. Soc. London (1888), 609, No. 140; STGR., Rom. Mém. Lép. (1892), 6, 257; LEECH, Trans. Ent. Soc. London (1899), 210, No. 676; HAMPSON, Cat. Lep. Phal. (1900), 2, 74, fig. 19, ♂; STGR. and REB., Cat. Lep. Pal. (1901), 1, 359, No. 4097; MATSUMURA, Cat. Insect. Jap. (1905), 1, 166, No. 1410; SEITZ, Macrolep. Faun. Pal. (1910), 2, 46, Pl. 10 *e*.

Nola albula Fixsen (nec Hübner) var. *a, mandschurica* [sic=*mandschuriana*] OBERTHÜR, Rom. Mém. Lép. (1887), 3, 327.

The larva figured (Plate I, fig. 3) was taken in July (figured July 5), 1902, at Hakodate, Oshima Province, Hokkaido (Yezo), on cherry, Japanese name, *sakura* (*? Prunus pseudocerasus* Lindl.).

This larva died, but several imagoes were obtained from other larvæ taken at the same time and place; one of these emerged

[3] This moth is unnamed in Japanese by Matsumura, and I have, therefore, named it.

July 30, 1902. The following description is taken from my original notes:

Larva.—Ashy gray. Long, slender hairs issue from segment 2 pointing forward, also from the spiracular line and anal segment. On segments 2 to 6 (counting head as segment 1) there are long dorsal tufts of ashy gray hairs; the tuft on segment 2 is the shortest, the tufts on segments 3 to 6 gradually increase in length, the longest tuft being on segment 6. The larva bears a most extraordinary vertical dorsal process situated between the head and the succeeding segment (Plate I, fig. 5). This process consists of five chitinous plates, apparently the sloughed plates of the head, which seem to indicate five molts, as the uppermost plate, counting from the top of the process, is the smallest; this would seem to prove that the sloughed plates are pushed upward vertically as each successive molt takes place.

Pupa.—The cocoon, or pupa case, is somewhat triangular with acute prolonged ends. It is attached to a twig and harmonizes exactly with the bark. Two long tufts of hair issue from the apex of the triangle.

Local distribution.—Honshu: Oiwake, Shinano Province (*Pryer*); Tokyo Musashi Province (*Fenton*); Yoshino, Yamato Province, May and June (*Wileman*); Karuizawa, Shinano Province, July (*Wileman*). Hokkaido (Yezo): Jozankei, Ishikari Province, and Hakodate, Oshima Province, July and August (*Wileman*).

Time of appearance.—Larva, July; imago, May to August.

General distribution.—Eastern Siberia (Sutschan and Ussuri, near Chabarovsk and Vladivostock, Askold Island); Korea; Japan.

ARCTIIDÆ

LITHOSIINÆ

Genus ILEMA Hübner

Ilema (*Eilema*) HÜBNER, Verz. (1827), 165.

Ilema griseola Hübner.

Plate I, fig. 6, larva (*Ilema ægrota* Butler); fig. 7, pupa and food plant. Japanese name, *kishita-hosoba.*

Bombyx griseola HÜBNER, Eur. Schmett. (1827), 2, fig. 97; LEECH, Proc. Zool. Soc. London (1888), 599, No. 87; ALPH. Rom. Mém. Lép. (1892), 6, 10; HAMPSON, Moths India (1894), 2, 80; LEECH, Trans. Ent. Soc. London (1899), 181, No. 575; HAMPSON, Cat. Lep. Phal. (1900), 2, 168; STGR. and REB., Cat. Lep. Pal. (1901), 1, 377,

No. 4294; MATSUMURA, Cat. Insect. Jap. (1905), 1, 179, No. 1498; MIYAKE, Tokyo Zool. Mag. [Tōkyō Dōbutsugaku Zasshi (Jap.)] (1910), 22, pt. 260, 334, 375, Pl. 11, fig. 12, ♂; SEITZ, Macrolep. Faun. Pal. (1910), 2, 65, Pl. 12 *g*, ♂; 12 *h*, ♀ and underside.

Lithosia flava HAW., Lep. Brit. (1809), 147; WOOD, Ind. Ent., 29, Pl. 8, fig. 99; STGR. and REB., Cat. Lep. Pal. (1901), 1, 377, No. 4294 *a*; (=*stramineola* Doubl.).

Lithosia stramineola DOUBL., Zool., 5, 1914.

Lithosia plumbeolata STEPH., Ill. Brit. Ent. Haust. (1829), 2, 96.

Lithosia serva WALKER, Cat. Lep. Het. (1854), 2, 506; MOORE, Proc. Zool. Soc. London (1878), 15, Pl. I, fig. 7; KIRBY, Cat. Het. (1892), 327.

Lithosia vetusta WALKER, Cat. Lep. Het. (1854), 2, 506; KIRBY, Cat. Het. (1892), 324; (=*amurensis* Stgr.).

Lithosia ægrota BUTLER, Ann. & Mag. Nat. Hist. (1877), IV, 20, 397; Ill. Typ. Lep. Het. (1879), 3, 8, Pl. 42, fig. 13; KIRBY, Cat. Het. (1892), 323; SEITZ, Macrolep. Faun. Pal. (1910), 2, 65, Pl. 12 *h* (=*adaucta* Butl., *cinerea* Pouj., *lenta* Leech); STGR. and REB., Cat. Lep. Pal. (1901), 1, 377, No. 4294 *b*.

Lithosia adaucta BUTLER, Ann. & Mag. Nat. Hist. (1877), IV, 20, 398; Ill. Typ. Lep. Het. (1878), 2, 6, Pl. 23, fig. 6; KIRBY, Cat. Het. (1892), 323.

Collita lilacina MOORE, Proc. Zool. Soc. London (1878), 16; KIRBY, Cat. Het. (1892), 324.

Lithosia cinerea POUJ., Bull. Soc. Ent. France (1886) (6), vi, cl; KIRBY, Cat. Het. (1892), 322.

Lithosia lenta LEECH, Entom. (1890), 23, 81.

Lithosia amurensis STGR., Rom. Mém. Lép. (1892), 6, 268; STGR. and REB., Cat. Lep. Pal. (1901), 1, 377, No. 4294 *b*.

Lepista subumbrata HOLLAND, Psyche (1893), 6, 411.

Lithosia fuscicilia HAMPSON, Moths India (1894), 2, 80.

The larva figured (Plate I, fig. 6) was taken in May (figured May 16), 1901, at Kobe, Settsu Province, Honshu, on a lichen; and a female imago of the form *ægrota* Butler emerged June 1, 1901.

Hampson[4] gives the following descriptions of the larva of *Ilema griseola* Hübner:

Larva, Meyrick, Brit. Lep. p. 28; Barrett, Lep. Brit. ii, p. 226, Pl. 67, fig. 1. Blackish brown, hairs dark brown; dorsal line black; subdorsal line orange-yellow interrupted, enlarged and partly confluent on somites 1, 2 and 12, otherwise rather faint; head shining black. Food-plants, Lichens and dead leaves; 8–6.

The original figure of my larva of *ægrota* Butler agrees best with this description.

[4] Cat. Lep. Phal. (1900), 2, 168.

Wilson[5] describes the larva of *Ilema griseola* Hübner as follows:

Larva. About ten lines long, and nearly black, the segmental divisions deeply cut; each segment has a number of black velvety tubercles, and each of these bears a tuft of short hairs; along each side of the back is an interrupted orange-colored *subdorsal* line; these lines approximate and then widen on segment 2, 3, and on segment 12 take the form of two orange spots; the ventral area is rather paler than the dorsal; legs and claspers the same; head small, black and shining.

Seitz[6] describes the larva of *Ilema griseola* Hübner as follows:

Larva black-grey, with reddish-yellow spots behind the head, from segment 3 backwards two reddish-yellow longitudinal stripes *dorsally* [not subdorsally as in Wilson] between which there is a black dorsal line. Until the beginning of June, on lichens on trees. Pupa glossy reddish brown, in a cocoon of moss or lichen. The moths in July and August, often common in Central Europe, and in Amurland (East Siberia) on tree-trunks and the branches of suckers.

Seitz does not say that the longitudinal reddish yellow dorsal stripes are interrupted as they are in my figure. Wilson says "an interrupted orange-colored subdorsal line."

Pupa.—Contained in a webbed cocoon spun on lichen (Plate I, fig. 7).

Miyake[7] states of the Japanese forms *ægrota* and *adaucta* that the larvæ are to be found on *sasa,* bamboo grass, and that they possibly feed upon that. I think, however, that they probably collect there to sun themselves, crawling up from lichens near at hand, as lichen is the food plant of *griseola* in Europe, and my larva was found on lichen.

Imago.—Leech[8] remarks:

The species [*griseola*] is a very variable one. The descriptions of *adaucta* and *ægrota* apply rather to individual specimens than to constant forms.

Ilema adaucta and *I. ægrota* are the forms of *I. griseola* occurring in Japan.

In the Far East the species varies considerably. In Amurland it is much smaller and the ground color of the forewing is so light that the costal stripe only slightly contrasts with it; this is *vetusta* Wlk. (=*amurensis* Stgr.). *Ægrota* Butl. (=*adaucta* Butl.; *cinerea* Pouj.; *lenta* Leech) on the other hand, is larger than European *griseola* and the forewing darker, the hindwing, which is yellow above, contrasting sharply with it; from Japan.[9]

[5] Larvæ of British Lepidoptera (1880), 59, Pl. 10, fig. 16.
[6] Seitz, Macrolep. Faun. Pal. (1910), 2, 65.
[7] *Tokyo Zool. Mag.* (1910), 22, pt. 260, 376.
[8] *Trans. Ent. Soc. London* (1899), 181.
[9] Seitz, Macrolep. Faun. Pal. (1910), 2, 65.

Local distribution.—I have taken *ægrota* and *adaucta* in the following localities: Honshu: Nikko, Shimotsuke Province, June; Tokyo, Musashi Province, May; Oyama, Sagami Province, May; Tennokawa, Yoshino, and Obatani, Yamato Province, June and July; Takami Toge (Pass), Ise Province, October. Kyushu: Kimbo-san, Kosadake, Haramachi, Higo Province, May, June, and July; Kagoshima, Satsuma Province, July. Hokkaido (Yezo): Junsai Numa, Oshima Province, July; Jozankei, Ishikari Province, August; Teshiwo, Teshiwo Province, July.

This species is common in most places in Japan. I found it especially abundant at Jozankei, near Sapporo, Hokkaido, in August, 1896.

Matsumura records the species from Hokkaido, Honshu, and Kyushu; and Miyake records it from the same islands. He gives the time of appearance as July and August and says that it is common in Hokkaido and not common in Tokyo, Honshu, so that it is evidently more abundant in the extreme north of Japan.

Time of appearance.—Larva, May; imago, June, July, August, September, October.

General distribution.—Europe; Altai; eastern Siberia (Amurland); Japan; northern China; Tibet; Nepal; Sikkim; Manipur; Yunnan; Borneo; western Africa (*Hampson*); Korea (*Matsumura, Miyake*).

This moth also occurs outside the Palæarctic Region: for example, as *lilacina* Moore and *fuscicilia* Hampson, in India; as *serva* Walker, in the Malay Archipelago (and Japan?); and as *subumbrata*, in West Africa. (*Seitz.*)

ARCTIIDÆ

ARCTIINÆ

Genus **DIACRISIA** Hübner

Diacrisia HÜBNER, Verz. (1827), 169.

Diacrisia subcarnea Walker.

Plate II, fig. 1, larva.

Japanese names, *obi-hitori, hara-aka-hitori.*

Spilosoma subcarnea WALKER, Cat. Lep. Het. (1855), 3, 675; KIRBY, Cat. Het. 232; BUTLER, Ill. Typ. Het. Lep. (1879), 3, 6, Pl. 42, fig. 8; LEECH, Proc. Zool. Soc. London (1888), 619, No. 188; Trans. Ent. Soc. London (1899), 149, No. 490; HAMPSON, Cat. Lep. Phal. (1901), 3, 315; MATSUMURA, Cat. Insect. Jap. (1905), 1, 172, No. 1446; DYAR, Proc. U. S. Nat. Mus. (1105), 28, 944; MIYAKE, Bull. Coll. Agr., Tokyo Imp. Univ. (1909), 8, No. 2, 161; SEITZ, Macrolep. Faun. Pal. (1910), 2, 86, Pl. 15 *d;* MATSUMURA, Thousand

Insects of Japan [Nihon Senchū Dzukai (Jap).] (1911), suppl. 3, 80, Pl. 36, fig. 9, ♂.

Aloa bifrons WALKER, Cat. Lep. Het. (1855), 3, 705; KIRBY, Cat. Het. (1892), 232.

Aloa leucothorax FELD., Wien. Ent. Mon. (1862), 6, 36; KIRBY, Cat. Het. (1892), 232.

Spilosoma erubescens MOORE, Ann. & Mag. Nat. Hist. (1877), IV, 20, 89; KIRBY, Cat. Het. (1892), 231.

Spilosoma rybakowi ALPH., Rom. Mém. Lép. (1897), 9, 171, Pl. 10, fig. 9, ♂.

Hyarias oberthüri SEMP., Schmett. Phil. (1899), 2, 489.

Diacrisia robustum HAMPSON, Cat. Lep. Phal. (1901), 3, 316 (aberr.).

Diacrisia subcarnea var. *flavoventris* MIYAKE, Bull. Coll. Agr., Tokyo Imp. Univ. (1909), 8, 162, ♀, with orange-yellow, instead of red, abdomen.

The larva figured (Pl. II, fig. 1) was taken in September (figured September 29), 1900, at Yoshino, Yamato Province, Honshu, on mulberry, Japanese name, *kuwa* (*Morus alba* Linn.); and a female imago emerged from the resulting pupa May 20, 1901. Two other females emerged May 14 and 16, respectively, from larvæ taken in the same month at the same place.

Miyake[10] describes the larva of *Spilosoma subcarnea* as follows:

> Larva. Ochraceous yellow with long ochraceous hairs; head and legs fulvous black; a brownish subdorsal line; tubercles greyish white. Food-plant: mulberry-tree. [This agrees well with the original figure of my larva.]

Dyar[11] remarks:

> The larva is a large hairy Arctian of the shape of the North American *Estigmene acrea* Drury, lightly colored as in pale specimens of *Diacrisia virginica* Fabricius. The head, thoracic feet and abdominal leg plates are black. Body immaculate, except for broken mottled dark subdorsal and substigmatal stripes. [This description was taken from a preserved specimen.]

Local distribution.—Honshu: Tokyo, Musashi Province, April, May, June, August (*Wileman*); Yoshino, Yamato Province, May, June, August, September (*Wileman*). Shikoku: Hosono, Iyo Province, August (*Wileman*). Kyushu: Hikosan, Buzen Province, August (*Wileman*). It has been found in Honshu, Shikoku, and Kyushu Islands; and Matsumura records it from Hokkaido (Yezo), Honshu, and Ryukyu (Loochoo).

Time of appearance.—Larva, September; imago, April to September. Double-brooded?

[10] *Bull. Coll. Agr., Tokyo Imp. Univ.* (1909), 8, 162.

[11] *Proc. U. S. Nat. Mus.* (1905), 28, 944.

General distribution.—Throughout Japan, China, and Korea; eastward to the Philippines and southward to the Malay Archipelago. (*Seitz.*)

Diacrisia nivea Ménétries.

Plate I, fig. 8, larva; fig. 9, food plant.

Japanese names, *shiro-hitori* and *kyo-joro.*

Dionychopus niveus MÉNÉTRIES, Bull. Phys. Math. Pétr. (1859), 17, 218; Schrenck's Reisen, Lep. (1859), 2, 52, Pl. 4, fig. 6; PRYER, Trans. Asiat. Soc. Japan (1885), 12, 48, No. 138; LEECH, Proc. Zool. Soc. London (1888), 620, No. 196; KIRBY, Cat. Lep. Het. (1892), 1, 229; STAUDINGER, Rom. Mém. Lép. (1892), 6, 289; LEECH, Trans. Ent. Soc. London (1899), 151, No. 494; STGR. and REB., Cat. Lep. Pal. (1901), 1, 365, No. 4165; BUTLER, Cist. Ent., 2, 32; HAMPSON, Cat. Lep. Phal. (1901), 267; MATSUMURA, Cat. Insect. Jap. (1905), 1, 173, No. 1453; MIYAKE, Bull. Coll. Agr., Tokyo Imp. Univ. (1909), 8, 157; SEITZ, Macrolep. Faun. Pal. (1910), 2, 88, Pl. 15 *h;* MATSUMURA, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1911), suppl. 3, 27, Pl. 32, fig. 4, ♀.

The larva figured (Plate I, fig. 8) was taken in June, 1902, at Hakodate, Oshima Province, Hokkaido (Yezo) on an herb of which I know neither the Latin nor the Japanese name. This larva died, but I bred two female imagoes at Hakodate on August 17 and 19, 1902, from larvæ compared with my original figure of the June larva.

Matsumura [12] describes the larva as follows and states that it feeds on *obako* (*Plantago major* Linn. var *asiatica* Dcne.) and *tampopo* (*Taraxacum officinale* Wigg. var *glaucescens* Koch): "Dark ashy-grey with long ashy-grey yellow hairs; pale lateral markings."

Graeser says that the larvæ, which hibernate in the young stage, are full grown by June and that the imago emerges in July.

Staudinger [13] describes the larva as follows:

Dirty-grey with lighter lateral markings and fascicles of long yellowish-grey hairs, which are not so bushy as in Arctia caja, but are thicker than in Arctia purpurata.

I describe my larva from the original figure as follows:

Larva.—Head ochraceous black with white V mark; body ruddy brown with the segmental divisions well marked by darker color; dorsal and lateral fascicles of hair ruddy gray; spiracles white; legs and prolegs ochraceous.

[12] Thousand Insects of Japan (1911), suppl. 3, 27.

[13] *Rom. Mém. Lép.* (1892), 6, 289.

Imago.—"Wings sometimes with traces of small blackish spots * * *. The moths in July and August, local but common at their flight places; they fly out of the grass making a noise, according to Doenitz. I could also hear a slight clicking sound of the wings when *niveum* flew close by me, like that made by many larger arctiids, especially *Callimorpha*, but also by the small *Parasemia plantaginis*."[14]

Leech says that the black discal spot of secondaries is sometimes absent.

Local distribution.—Honshu: Nikko, Shimotsuke Province, July and August (*Wileman*); Yoshino, Yamato Province, July and August (*Wileman*); Karuizawa, Shinano Province, July (*Wileman*). Hokkaido: Hakodate, Oshima Province, August (*Wileman*).

Matsumura records the species from Karafu-to (Saghalin), Hokkaido, Honshu, Kyushu, Shikoku, Korea, China, and Manchuria. He includes Shikoku as a locality in one of his works and excludes it in another.

Time of appearance.—Larva, June; imago, July and August.

General distribution.—Throughout eastern Asia, eastern Siberia (Amurland), China with the exception of the south, Korea, and Japan. (*Seitz.*)

Diacrisia imparilis Butler.

Plate I, fig. 10, larva; fig. 11, head; fig. 12, dorsal section.

Japanese name, *kuwa-gomadara-hitori.*

Spilarctia imparilis Butler, Ann. & Mag. Nat. Hist. (1877), IV, **20**, 394, ♂; Ill. Typ. Het. (1878), **2**, 4, Pl. 22, fig. 4, ♂; Ann. & Mag. Nat. Hist. (1879), V, **4**, 351, ♀; Fixsen, Rom. Mém. Lép. (1887), **3**, 334, ♂ and ♀; Leech, Proc. Zool. Soc. London (1888), 620, No. 193; Trans. Ent. Soc. London (1899), 153, No. 501; Matsumura, Japanese Injurious Insects [Nihon Gaichuhen (Jap.)] (1899), 29, Pl. 12, figs. 1 and 2, imago ♂ and ♀; fig. 3, ova; fig. 4, larva; fig. 5, pupa; Kirby, Cat. Het. (1892), 232; Hampson, Cat. Lep. Phal. (1901), **3**, 308; Matsumura, Cat. Insect. Jap. (1905), 172, No. 1451; Dyar, Proc. U. S. Nat. Mus. (1905), **28**, 944, fig. 6, larva; Miyake, Bull. Coll. Agr., Tokyo Imp. Univ. (1909), **8**, No. 2, 166; Matsumura, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1911), suppl. **3**, 4, Pl. 30, fig. 5, ♀; Seitz, Macrolep. Faun. Pal. (1910), **2**, 87, Pl. 15 *f*, ♀; Sasaki, Kwaju Gaichūhen [Insects Injurious to Fruit Trees (Jap.)], ed. 5 (1911), 60 and 197, Pl. 14, larva and imago.

The larva figured (Plate I, fig. 10) was taken in July (figured July 7), 1902, at Hakodate, Oshima Province, Hokkaido (Yezo), on *niwatoko* (*Sambucus racemosa* Linn.), and a male imago emerged August 16, 1902. Another larva pupated August 8, 1902, and the imago emerged August 11, 1902.

[14] Seitz, Macrolep. Faun. Pal. (1910), **2**, 88.

The larva is one of the commonest of the arctiids in Tokyo and is to be met with in May and June on many kinds of low-growing herbs and shrubs. It is closely allied to the larva of *Diacrisia infernalis* Butl. The pupa is inclosed in a loose-webbed cocoon, spun in leaves of the food plant.

Matsumura [15] records the life history of this species and gives figures of the imago, male and female; the ova; the larva; and the pupa. He says that in Hokkaido the species is single-brooded. The larva hibernates after the second molt, on or near the food plant, until the spring of the following year. The imago emerges at the end of July. The female imago covers the ova, which are approximately two hundred in number, with hairs from the anal tuft. It is possible that this species is double-brooded in southern Honshu.

The eggs are laid in a patch covered by the brownish wool from the abdomen of the female moth.

The larvæ resemble those of *Arsilonche albovenosa* in color, being black with yellow spots and red warts. The hairs are black and white, rather thin and do not obscure the body coloration. Head rounded, bilobed, flat before, shining black, paraclypeus reddish, epistoma and bases of antennæ white. Body cylindrical, normal, with large, elevated, bright-red warts. Wart i is small, ii, iii, and v large, iv absent, vi large, black, base of leg broadly hairy. On the thorax, two warts above the stigmatal wart, normal. Cervical shield densely hairy. Black; a dorsal yellow line, broken into two spots on each segment; fine yellow dottings to a narrow broken subdorsal line; sides more heavily dotted to a waved broken substigmatal line. Feet reddish with black shields.

The cocoon is composed of hair and thin silk. The pupa has the usual Arctian shape.[16]

The above description of the larva appears to have been taken from preserved specimens. Dyar does not mention the metallic blue described by Miyake.

Larva. Purplish fuscous, with hairs of greyish white and greyish black; head and legs greyish fuscous; a dorsal and subdorsal series of greyish yellow spots; tubercles mostly ochraceous brown, some of 6–12 somites metallic blue; prothoracic shield metallic blue.

Food-plants: mulberry-, peach-, pear-, plum-, cherry-, apple-tree and many others.[17]

Imago.—Diacrisia imparilis Butl. and *D. infernalis* Butl. are closely allied to each other in the larval and the imaginal stages. The male imagoes of both species are blackish brown, and the

[15] Japanese Injurious Insects (Nichon Gaichūhen) (1899), 29.
[16] Dyar, *Proc. U. S. Nat. Mus.* (1905), 28, 944, fig. 6, larva.
[17] Miyake, *Bull. Coll. Agr., Tokyo Imp. Univ.* (1909), 8, 167.

females are creamy white and pale buff. Leach remarks of *imparilis* that—

> the black maculation is a variable character in the female; one example of this sex from Hokkaido (Yezo) is devoid of markings with the exception of a black dot on the left primary.

I possess a specimen similar to that described by Leech.

Local distribution.—Honshu: Tokyo, Musashi Province, August (*Wileman*); Nikko, Shimotsuke Province, August (*Wileman*); Yoshino, Yamato Province, August and September (*Wileman*). Hokkaido: Hakodate, Oshima Province, August (*Wileman*). Throughout the Japanese Islands (*Matsumura, Seitz*); very common in Hondo (Honshu); the larvæ are very common on various plants in Tokyo (*Miyake*).

Time of appearance.—Larva, May, June, and July, hibernates; imago, July, August, and September. Single-brooded.

General distribution.—Japanese Islands only.

Diacrisia infernalis Butler.

Plate II, fig. 2, larva; fig. 3, food plant; figs. 4 and 5, imago and head of variety 1, *immaculalis* nov., ♀; figs. 6 and 7, imago and head of variety 3, ♀, unnamed; figs. 8 and 9, imago and head of variety 4, *maculalis* nov., ♀.

Japanese name, *kurobane-hitori* and *kurohane-hitori.*

Thanatarctia infernalis Butler, Ann. & Mag. Nat. Hist. (1877), IV, 20, 395; Ill. Typ. Lep. Het. (1879), 3, 7, Pl. 42, fig. 9, ♂; Leech, Proc. Zool. Soc. London (1888), 617, No. 182; Kirby, Cat. Het. (1892), 277; Leech, Trans. Ent. Soc. London (1899), 160, No. 519; Hampson, Cat. Lep. Phal. (1901), 3, 312, ♂ and ♀; Matsumura, Cat. Insect. Jap. (1905), 173, No. 1456; Miyake, Bull. Coll. Agr., Tokyo Imp. Univ. (1909), 8, 167; Seitz, Macrolep. Faun. Pal. (1910), 1, 87, Pl. 15 *f*, ♂; Matsumura, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1911), suppl. 3, 6, Pl. 30, fig. 9, ♀.

The larva figured (Plate II, fig. 2) was taken in May (figured June 1), 1901, at Kobe, Settsu Province, Honshu, on willow, Japanese name, *yanagi* (*Salix*). A female imago emerged from the resulting pupa in July, 1901. This female is not typical, but is an interesting aberration and is much more heavily maculated with fuscous spots than variety 4, *maculalis* var. nov. (Plate II, figs. 8 and 9). It shows basal, antemedial, and postmedial bands on the forewings, the buff-colored ground color showing through but faintly on all the wings, especially on the hind ones. I bred a black male imago on July 3, 1901, at Kobe, the larva of which agreed with my original figure of the larva that produced this female aberration; otherwise I might have regarded it as the female of a different species. Subsequent experience at Hako-

date in 1902 and 1903 proved to me the extreme variability of the females of this species as will be perceived by the notes on four varieties. I have taken the young larvæ at Hakodate in October, so that in Hokkaido, where the winter is very severe and lasts for five months, the larva probably hibernates. The pupa is brownish black and is inclosed in a loose-webbed cocoon.

I also bred two males, July 24 and August 2, 1902, respectively, at Hakodate, Hokkaido.

Larva. Purplish fuscous with mixed hairs of whitish and blackish; head ochraceous brown; legs brownish; a yellowish dorsal line with some indistinct irregular lateral lines; tubercles of dorsal half metallic blue; lateral ones ochraceous brown. Food-plants: mulberry-, peach-, pear-, cherry-, apple-tree; *Quercus serrata; Q. glandulifera;* &c.[18]

The above description of the larva agrees well with my original figure with one exception. In my figure a yellowish midlateral line is represented; perhaps Miyake includes this in "some indistinct irregular lateral lines." Like its near ally, *Diacrisia imparilis*, it seems to be a general feeder.

Imago.—The female of this species is subject to very great variation in the fuscous markings of the fore- and hindwings. In a series of seventeen examples especially selected out of forty-one specimens (most of them captured near Hakodate) with the object of illustrating this variation, no two specimens are exactly alike in markings. Generally speaking, they can be divided into four varieties.

Variety 1 (Plate II, figs. 4 and 5), immaculalis var. nov., collection Wileman No. 269. Immaculate; fuscous markings referred to by Hampson[19] in his description entirely obsolete on the upper side of both fore- and hindwings; on the underside the discocellular spot of the forewing and the discoidal spot of the hindwing are faintly perceptible.

Variety 2, unfigured, unnamed. Fuscous markings *very faint*, being faintly present in some specimens on both fore- and hindwings and in other specimens on the hindwings only.

Variety 3 (Plate II, figs. 6 and 7), unnamed, collection Wileman No. 269*c*. Moderately maculated; the fuscous markings on both the fore- and hindwings are more prominent; two spots, one on subcostal nervure and one on costa of forewing; the commencement of an interrupted antemedial band is represented by four spots, one on the inner margin, one beyond vein 1, one on discocel-

[18] Miyake, *Bull. Coll. Agr., Tokyo Imp. Univ.* (1909), **8**, 167.
[19] *Cat Lep. Phal.* (1901), **3**, 312, ♂ and ♀.

lulars, and one on the costa of forewing. This interrupted antemedial band is more complete in variety 4, *maculalis* (see the following paragraph), in which it is interrupted between veins 3 and 6 at the point where is should bend inward to the costa like the postmedial band.

Variety 4 (Plate II, figs. 8 and 9), maculalis var. nov., collection Wileman No. 269*e*. Heavily maculated; the antemedial band continues nearly to vein 3, where it is interrupted and then continues in two spots, one discocellular and one on the costa; on the hindwing a well-defined, submarginal band of spots, which is continuous in some specimens from inner angle to apex, interrupted in others; discoidal spots very prominent.

A comparison of the immaculate form, var. 1, *immaculalis*, with the heavily maculated form, var. 4, *maculalis*, leads one almost to believe that they are two different species unless in possession of a long series showing the intergrades between the two forms. Taking into consideration the great variability of the female, I think it is unnecessary to give names to varieties 2 and 3.

I have captured *Diacrisia infernalis*, both male and female, in some numbers at Junsai Numa (Junsai Lake), near Hakodate, Hokkaido (Yezo). The female, as also recorded by Miyake, covers the ova with hairs from the anal tuft. The male has a peculiar gyrating flight and on sunny days can be seen careering round the tops of low trees and then suddenly disappearing for a rest. I also found many males (which, like *Diacrisia imparilis*, are blackish brown) in copula with females in the woods about Junsai Numa, lying exposed on the low herbage.

Local distribution.—Honshu: Nikko, Shimotsuke Province, July and August (*Wileman*); Kobe, Settsu Province, July (*Wileman*); Myanoshita, Sagami Province, June (*Wileman*); Oiwake, Shinano Province, 3 males, 1 female in the British Museum collection (*Pryer*). Hokkaido: Hakodate, Junsai Numa, Oshima Province, July and August (*Wileman*); Jozankei, near Sapporo, Ishikari Province, August (*Wileman*). I captured 23 male and 18 female specimens at the above localities in June, July, and August of different years.

Miyake says: "Not very rare in Hokkaido and Hondo; I have received some specimens captured in Tokyo."

Matsumura records the species from Honshu and Hokkaido and says that it is common at Sapporo, Hokkaido.

Time of appearance.—Larva, May to October, hibernates? Imago, June to August. Single-brooded?

General distribution.—Japan only. (*Seitz.*)

Genus ARCTIA Schrank

Arctia SCHRANK, Fauna Boica (1802), 2, 152.

Arctia caja Linnæus.

Plate II, figs. 10 and 11, larva; fig. 12, head; fig. 13, dorsal aspect. Larva of *Arctia caja* var. ? *phæosoma* Butler.

Japanese names, *hitori-ga, odoriko-ga, hyo-mushi.*

Bombyx caja LINNÆUS, Syst. Nat. (1758), 1, 500; Esp. Schmett. (1789), 3, 167, Pls. 30–32; LEECH, Proc. Zool. Soc. London (1888), 617, No. 179; Trans. Ent. Soc. London (1899), 159, No. 517; STGR., Rom. Mém. Lép. (1892), 278; KIRBY, Cat. Het. (1892), 258; MATSUMURA, Japanese Injurious Insects [Nihon Gaichūhen (Jap.)] (1899), 33, Pl. 14, fig. 1, imago; fig. 2, larva; STGR. and REB., Cat. Lep. Pal. (1901), 1, 368, No. 4201; HAMPSON, Cat. Lep. Phal. (1902), 3, 463; MATSUMURA, Cat. Insect. Jap. (1905), 1, 175, No. 1467; MIYAKE, Bull. Coll. Agr., Tokyo Imp. Univ. (1909), 8, 171; MATSUMURA, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1911), suppl. 3, 21, Pl. 31, fig. 12, ♀; SEITZ, Macrolep. Faun. Pal. (1910), 2, 98, Pl. 18 *b*, ♂; OBERTHÜR, Etud. d'Ent., 20, Pls. 13–15, figs. 227–262 (aberrs.).

Phalæna erinacea RETZ., Gen. Spec. Ins. (1783), 36.

Arctia caja var. *wiskotti* STGR., Hor. Ent. Ros. (1878), 14, 333; SEITZ, Macrolep. Faun. Pal. (1910), 2, 98.

Arctia orientalis MOORE, Ann. & Mag. Nat. Hist. (1878), V, 1, 230; HAMPSON, Moths India (1894), 16.

Arctia americana HARRIS, Rep. Ins. Mass. (1841), 246; in Agassiz and Cabot, Lake Superior (1850), 391, Pl. 7, fig. 5.

Euprepia phæosoma BUTLER, Ann. & Mag. Nat. Hist. (1877), IV, 20, 395; Ill. Typ. Lep. Het. (1879), 3, 7, Pl. 42, fig. 10, ♀; KIRBY, Cat. Het. (1892), 259; SEITZ, Macrolep. Faun. Pal. (1910), 2, 98, Pl. 18 *b*, ♀.

Euprepia phaeosoma var. *auripennis* BUTLER, Trans. Ent. Soc. (1881), 7; MATSUMURA, Cat. Insect. Jap. (1905), 1, 175, No. 1467.

Euprepia opulanta H. EDWARDS, Papilio (1881), 1, 38; KIRBY, Cat. Het. (1892), 259.

Two larvæ are figured (Plate II, figs. 10 and 11). One (fig. 11) was taken in August (figured August 22), 1900, at Yoshino, Yamato Province, Honshu, from which no imago was bred, and one (fig. 10) was taken in June (figured June 7), 1902, at Hakodate, Oshima Province, Hokkaido (Yezo). The food plant is unknown, as no notes were taken.

From the larva taken in June, 1902, a male imago emerged August 26, 1902. In this specimen the white markings on the forewings are slender (aberratively reduced) and are for the most part replaced by the brown spots. As the specimen is not at hand, I am unable to say whether it is referable to *phæosoma* Butler, which is the normal form in Japan.

Larva.—Velvety black; each segment having a number of black shining tubercles, from which proceed very long hairs, those on the dorsal area are

mixed grey and black, those on the 2nd and 3rd segments amber brown; along each side the hairs are of a lighter brown; the spiracles are golden; head legs and claspers shining black.[20]

Wilson counts the head as segment 1. In his figure (fig. 9) the dorsal and lateral hairs on segments 2 and 3 are distinctly amber-brown.

Egg greenish white, larva with very long and dense hair, which is red on the anterior segments and on the others black above and only red laterally, placed on warts with a whitish gloss; when touched roughly the hairs sting slightly, but do not cause any noteworthy inflammation. From September until May, at the edges of woods, on meadows in the woods, on nettles, dandelion and many other low-growing plants. Attempts to breed aberrations by feeding the larvae with certain plants (foliage of walnut, etc.) were not successful. Common.[21]

The hair is red on the anterior segments above and on the others black above and only red laterally.

Larva.—Meyr. Brit. Lep. 42; Barrett, Lep. Brit. 268, Pl. 7, fig. 1. Black; hairs very long, black and grey, browner on sides and on 1st and 2nd somites reddish brown; head black. Food-plants: Urtica, Plantago, etc. 8–5. Great Britain.[22]

The hairs on first and second somites are reddish brown.

Larva. Head black with reddish-brown spot at sides; body black; each body-segment with two deep-black tubercles on subdorsal line, one on supra-, subspiracular and basal lines; tubercles on subdorsal and subspiracular lines thickly covered with longer or shorter light greyish yellow hairs; tubercles on subspiracular and basal lines with short reddish brown hair; thoracic legs black; abdominal legs dark brown. Food-plants: hemp, rape, mulberry-tree. *Ribes grossularioides.—Prof. Sasaki.*[23] [Nothing is said of segments 2 and 3 (counting head as segment 1) being reddish brown or amber-brown.]

It will be noted that Hampson, Wilson, and Seitz state that the hair on anterior segments 1 and 2 (or counting head as segment 1, on 2 and 3, Wilson) is red, reddish brown, or amber-brown. Sasaki does not notice this, and it is not apparent in the original figures of my larvæ. This is possibly the distinguishing feature of the larva of *phæosoma,* the normal Japanese form of *caja.*

In the original figure of my Hakodate larva (Plate II, fig. 10) the spiracles are white; this is not mentioned by the foregoing authors.

[20] Wilson, Larvæ of British Lepidoptera (1880), 64, Pl. 11, figs. 9, 9*a*.
[21] Seitz, Macrolep. Faun. Pal. (1910), 2, 99.
[22] Hampson, Cat. Lep. Phal. (1901), 3, 465.
[23] Miyake, *Bull Coll. Agr., Tokyo Imp. Univ.* (1909), 8, 172.

Matsumura [24] records the life history of this species and gives figures of the imago and larva.

He says that in Hokkaido—

It is single-brooded and hibernates in the larval stage. It attains full growth from May to the beginning of June and the imago emerges four or five weeks afterwards. It is extremely abundant both in the larval and imaginal stages at Sapporo, Hokkaido.

Imago.—"In Asia caja is considerably larger than in Europe; already in Asia Minor it is larger, with much white on the forewing and the hindwing in the male almost white, this is *wiskotti* Stgr. *Phæosoma* Butler from Eastern Asia is at once *distinguished by the white tegulæ.* In this form, which is the normal one in Japan, East Siberia, Korea and North China, the white may be predominant on the forewing, but may also be aberratively reduced as in European specimens. In East Asia where the larva of phæosoma is locally extraordinarily abundant (Greaser), specimens often occur with yellow abdomen and hindwing; this is ab. auripennis Butl. In orientalis Moore, from Kashomir to the Khasia Hills, the thorax and forewing are more yellowish red-brown, as in certain local worms in North America, where caja occurs in some very different varieties (utahensis, opulenta, transmontana)".[25]

The female type of *auripennis* Butler is from Tokyo, Honshu (*Fenton*), and the female type of *phæosoma* Butler is from Yokohama, Honshu (*Jonas*).

Local distribution.—Honshu. In British Museum collection: Oiwake, Shinano Province (*Pryer*); Tokyo, Musashi Province (*Fenton*), type *auripennis;* Yokohama, Musashi Province (*Jonas, Pryer, Lewis*), type *phæosoma;* Nikko, Shimotsuke Province (*Maries*). In the Wileman collection: Tokyo and Yokohama, August and September, *phæosoma?* Hokkaido: Shikubi, Oshima Province, August, *auripennis.* Matsumura records *caja* from Hokkaido and Honshu and says that it is very abundant at Sapporo, Hokkaido; he records *auripennis* also from Sapporo.

Time of appearance.—Larva, May and June; imago July, August, and September.

General distribution.—*Arctia caja.*—Throughout Europe and anterior Asia, from Scandinavia, Lapland, and northern Russia southward to the Mediterranean and from the Atlantic Ocean to the Pamir, Kashmir, and even Assam. (*Seitz.*)

Arctia phæosoma.—Hampson includes *phæosoma* Butl. and *opulenta* H. Edw. under the subspecies *americana* Harris, from North America. Tegulæ with a broad white band in front. Abdomen and hindwing scarlet. Japan, eastern Siberia, Korea, North China.

[24] Japanese Injurious Insects (Nihon Gaichūhen) (1899), 33.

[25] Seitz, Macrolep. Faun. Pal. (1910), 2, 98, 99.

Ab. 1, *opulenta*.—Forewing with the white markings very extensive and occupying the greater part of wing. Amur and Alaska.

b, americana.— Abdomen scarlet; hindwing yellow. North Atlantic States.

c, auripennis.—Abdomen and hindwing yellow. Japan.

ERRATA IN NOTES ON JAPANESE LEPIDOPTERA AND THEIR LARVÆ, PARTS II AND III

This Journal Sec. D (1915), 10, No. 5:

Page 284: In line 19 for Honshu read Kyushu.
Page 286: In line 36 for Seib. read Sieb.
Page 293: In line 26 for at Hokkaido read in Hokkaido.
Page 293: In line 29 for Gersan read Gensan.
Page 293: In line 38 for *attillia* read *attilia*.
Page 305: In line 20 for *ochrace* read *ocharcea*.

This Journal Sec. D (1915), 10, No. 6:

Page 351: In line 12 for *schiroseuji* read *shirosuji*.
Page 353: In line 27 for *Sipirama* read *Spirama*.
Page 353: In line 37 for Hokodate read Hakodate.
Page 354: In line 40 for *kohoha* read *konoha*.
Page 357: In line 24 for CHACOSIINÆ, read CHALCOSIANÆ.
Page 360: In line 39 for Yomata read Yamato.
Page 361: In line 1 for Busen read Buzen.

ILLUSTRATIONS

[Drawings by Hisashi Kaidō.]

Plate I

Figs. 1 and 2. *Chelonomorpha japona* Motschulsky.
1, larva; *2*, food plant.
3 to 5. *Roeselia mandschuriana* Oberthür.
3, larva; *4*, food plant; *5*, head and dorsal process.
6 and 7. *Ilema ægrota* Butler.
6, larva; *7*, pupa and food plant.
8 and 9. *Diacrisia nivea* Ménétries.
8, larva; *9*, food plant.
10 to 12. *Diacrisia imparilis* Butler.
10, larva; *11*, head; *12*, dorsal section.

Plate II

Fig. 1. *Diacrisia subcarnea* Walker, larva.
Figs. 2 to 9. *Diacrisia infernalis* Butler.
2, larva; *3*, food plant; *4*, imago of variety 1, *immaculalis* nov., ♀; *5*, head of variety 1, ♀; *6*, imago of variety 3, ♀; *7*, head of variety 3, ♀; *8*, imago of variety 4, *maculalis* nov., ♀; *9*, head of variety 4, ♀.
10 to 13. *Arctia caja* var. ? *phœosoma* Butler.
10 and *11*, larva; *12*, head of larva; *13*, dorsal aspect of larva.

PLATE I. CHELONOMORPHA JAPONA, ROESELIA MANDSCHURIANA, ILEMA ÆGROTA, DIACRISIA NIVEA, AND D. IMPARILIS.

PLATE II. DIACRISIA SUBCARNEA, D. INFERNALIS, AND ARCTIA CAJA VAR. ? PHŒOSOMA.

FOURTH CONTRIBUTION TO THE COLEOPTERA FAUNA OF THE PHILIPPINES.

By W. SCHULTZE
(*Manila, P. I.*)

ONE PLATE

This paper is mainly an addition to the knowledge of the pachyrrhynchid group of the Curculionidæ found, with a very few exceptions,[1] in the Philippine Islands.

CERAMBYCIDÆ

Acronia pretiosa sp. nov. Plate I, fig. 1.

Head: clypeus and mandibles black, frons and vertex dark blue, with irregularly scattered needle punctures and a fine medial groove. A creamy white transverse stripe at the base of the clypeus, continued on the sides of the head. Two oblique stripes arise at the middle from the base of the clypeus, run just above the eye, and terminate on the vertex. These two stripes form the letter V. Antennæ bluish black, basal half of second and third joints creamy white. Thorax dark blue with a metallic luster. Two transverse bands, one next to the anterior and the other next to the posterior margin, joining a lateral marginal stripe, both the former bands interrupted in the discal area. Sides and underside of thorax, abdominal segments, and femora glossy metallic green. Elytra dull bluish black, remotely and regularly punctured, but the basal area coarsely and confusedly punctured. A transverse band, at the end of the basal third of the elytra, to the outer margin, another transverse band at the end of the second third, running obliquely behind to the

[1] Non-Philippine species known so far are the following: *Pachyrrhynchus croesus* Oberth., Sanghir Island; *P. forsteni* Vollh., Ternate, Halmaheira, and Sumatra; *P. infernalis* Fairm., Ishigahi-Sima Island; and *P. morotaiensis* Vollh., Morotai. In 1912 Professor Heller published in This Journal his very commendable paper, Philippinische Rüsselkäfer. In the same he included in the keys, also, the above-mentioned non-Philippine species, without calling attention to that fact, except in the case of *P. morotaiensis* Vollh. Through an oversight, I included also the above-named species in my Catalogue of the Philippine Coleoptera, which mistake I wish to correct herewith.

outer margin. The central area, which is inclosed by the transverse bands, has a whitish opalescent aspect.

A short longitudinal and slightly curved stripe from the middle of the base of each elytron, but not reaching the first transverse band. Also from the base to the second transverse band a narrow sutural stripe and in the apical third of each elytron an anteriorly forked subsutural stripe, which is recurved in the apical triangle toward the outer margin and joins the second transverse band. The suture is apically slightly raised. Each femur, with two tomentose spots. Tibia dull dark blue and finely bristled above apically. First abdominal segment with a band at the fore margin. Outer margin of all abdominal segments and the last segment almost entirely creamy white tomentose. The latter with a longitudinal medial groove, a character that is also found in the genus *Aprophata*.[2]

Length, 18 millimeters; width, 7.

CATANDUANES, Virac. Type in my collection.

The type of the genus *Acronia* is *perelegans* Westwood,[3] also from the Philippines; Luzon, Tayabas Province, Casiguran (*Semper*).

CURCULIONIDÆ

Pachyrrhynchus sumptuosus sp. nov.

Head, thorax, legs, and underside glossy black, with a coppery luster. Elytra dull glossy, iridescent purplish brown or green. Rostrum finely and sparsely punctured, a prominent pitlike depression in the basal half. In the depression a rather indistinct longitudinal groove. Thorax with an indistinct groove near the fore margin, laterally only. Hind margin raised. Female with a group of very minute bronze-green scales at the lateral margin. Each elytron with a row of punctiform impressions near the outer margin, extending from the middle to the apex. In the apical part these depressions run together, forming a groove.

[2] I described in *This Journal, Sec. D* (1916), 11, 348, *Abryna ? hoffmeisteri*, placing the species provisionally in the above-mentioned genus, following Westwood's conception. The species *hoffmeisteri* Schultze should be placed in the genus *Aprophata*. Furthermore I find that *A. hoffmeisteri* is identical with *A. ruficollis* Heller. *Deutsche Ent. Zeitschr.* (1916), 308. Through the kindness of Professor Baker I received a reprint of Heller's paper, but from it I am unable to state the date of publication and whether the former (issued January 3, 1917) or the latter specific name will have priority.

My copies of the Deutsche Entomologische Zeitschrift, as well as those for the library of the Bureau of Science, Manila, are evidently being held up or lost.

[3] Westwood, *Trans. Ent. Soc. London* (1863), III, 633, Pl. 24, fig. 4.

Femora with a strongly excavated depression below, apically. At the depression minutely fine scales and hair. Tibia below very minutely denticulate and beset with fine hair.

Male, length, 12.5 millimeters (without rostrum); width, 5. Female, length, 16 millimeters (without rostrum); width, 7.

LUZON, Bontoc. Types in my collection.

This species is easily recognized by the very peculiar coloration of the elytra.

Pachyrrhynchus igorota sp. nov. Plate I, fig. 2.

Dull glossy, black. Rostrum apically broader than at the base. Apical area densely punctured. Rostrum transversely set off at the middle, posterior of which a deep depression, the lateral edges of which are strongly produced. A creamy white scale spot posterior of the antennal groove. Thorax as long as broad. Laterad of the middle an irregular spot composed of a few scales and posteriorly of the latter at the hind margin a wedge-shaped spot. A longitudinal lateral facia from the fore to the hind margin. Each elytron with three narrow creamy white stripes: One from the base straight across the disk to the apex; another laterad, beginning a short distance from the base and terminating a short distance before the apex; and another broad outer marginal stripe arising similarly some distance from the base and terminating before the apex. Pro- and mesosternum with a triangular spot between the coxæ, the latter also with a spot laterad. Metasternum and first abdominal segment with a lateral spot only. Femora with a spot on the underside near the apex.

Male, length, 18 millimeters (without rostrum); width, 7. Female, length, 20 millimeters (without rostrum); width, 8.5.

LUZON, Benguet, Haight's Place (2,700 meters). Types in my collection.

The males of this species have the spots on the thorax mostly very much reduced or entirely absent. Also the stripes on the elytra, with the exception of the one on the lateral margin, are sometimes interrupted in the middle. In one specimen the second stripe is reduced to one fourth of the normal length, basally. This species is mostly covered with a sticky substance, so that it is very difficult to obtain perfectly clean specimens. Whether this is due to a kind of natural perspiration or to certain peculiarities of the food plant with which the insect comes in contact, I am unable to say at the present. Through my native collector, as well as through the kindness of Messrs. C. Hoffmeister and O. Schütze, I received a large number of specimens, all from

the above-mentioned locality.[4] It seems that the range of this species is very limited. This species is closely related to *P. modestior* Behr., but is easily distinguished from the latter by the usually larger size, the narrower stripes on the elytra, and the absense of a spot between the eyes. The color of *P. modestior* is mostly dark glossy green, but in all the specimens of *P. igorota* that were examined, the color is dull glossy black.

Pachyrrhynchus loheri sp. nov. Plate I, fig. 3.

Glossy black, elytra with very broad, light green, longitudinal scale stripes. Rostrum comparatively short, transversely set off and emarginate in the middle. Apical part densely punctured, in the basal part a deep depression with a scale spot, the lateral edges prominently produced. Frons with a punctiform impression. Thorax longer than broad. A broad band at the anterior margin, which narrows toward the sides, but continues to the hind margin where it terminates laterad in a shallow depression. Hind margin dorsad with a broad band composed of two elongated closely approximated spots. Somewhat behind the middle, laterad, a shallow depression with a nearly round scale spot. From the latter to the posterior margin a slightly raised keel. Elytra cordiform, broadest before the middle. Each elytron with five longitudinal stripes, which are broader than the interspaces, except the sutural stripes. The latter begin before the middle, becoming somewhat narrower and again broader toward the apex. The second stripe unites with the marginal near the apex. The interspaces are somewhat elevated. Abdominal segments finely wrinkled like leather and with a few scattered scales. Each femur with a spot near the apex, antad.

Length, 18 millimeters (without rostrum); width, 8.

LUZON, Bulacan, Mount Guinuisan (*A. Loher*). Type in my collection.

This species is to be placed in Heller's group II.[5]

Among the other species of this group *P. loheri* is easily recognized by the cordate elytra.

[4] The mountainous regions of central and northern Luzon appear to be the ancestral home of the *Pachyrrhynchus-Apocyrtus* groups, since by far the most species of these groups, known from the Philippines, are found in the indicated regions, and many more will be discovered in the vast yet unexplored areas. For example, at Baguio (altitude, about 1,500 meters) and close neighborhood the following species of *Pachyrrhynchus* are found: *Pachyrrhynchus anellifer* Hell., *annulatus* Chevr., *argus* Pasc., *coerulans* Kraatz, *congestus* Pasc., *pulchellus* Behr., *sanchezi* Hell., and *zebra* Schultze, besides several other species not yet identified.

[5] *This Journal, Sec. D* (1912), 7, 305.

Pachyrrhynchus schuetzei sp. nov. Plate I, fig. 7, ♀.

Black, with a coppery gloss and numerous yellowish white scale ringlets. Rostrum set off transversely in the middle. On the basal part a small, double, scale spot divided by a longitudinal groove. The latter terminates between the eyes and is somewhat shorter, as in *P. anellifer* Heller. Thorax a little broader than long. Anterior and posterior margin with a fine scale line. A shallow, longitudinal, middle groove along which a few scales are located. In the middle, but laterad, a shallow dimplelike depression surrounded by a ring of scales. At the lateral margin a group of a few scales. Elytra with irregular rings of scales in transverse rows. The first row parallel to the basal margin, each elytron having three large oval rings and four smaller spots. The spaces within the large rings are frequently filled with scales. In the first row the location of the spots is as follows: a small dotlike spot next to the suture, two larger ones in the middle, a few small ones, again one larger, and a small one at the lateral margin. The second row runs about parallel to the first row, each elytron with four larger and next to the lateral margin a few small spots. A third interrupted row, composed of two rings on each elytron, is located at the beginning of the apical third thereof. Between the second and third rows, as well as in the apical area of the elytron, a subsutural double spot, the latter being rather long and narrow. In the apical triangle a large, irregular, triangular spot. Scattered among different larger rings of the elytra are a number of scaly dots. In the male the elytra are not so glossy as in the female; in the former they have very slight indications of longitudinal furrows, and the spots are more dotlike.

Male, length, 11 millimeters (without rostrum); width, 5. Female, length, 14 (without rostrum); width, 6.

LUZON, Benguet, Haight's Place (*O. Schütze*). Types in my collection.

This species has a superficial resemblance to *P. anellifer* Heller, but I have numerous specimens of both species before me and there are no intermediate forms among them. The differences between the two species seem to be very constant. It appears as if *P. annulatus* Chevr., *P. anellifer* Heller, and *P. schuetzei* are closely related species, which represent, so to say, transitional stages of their evolution.

Pachyrrhynchus zebra sp. nov. Plate I, fig. 5.

Black, with longitudinal, light bluish or greenish scale stripes. Rostrum with a deep pitlike depression in the middle, which

disperses between the eyes. Frons with a fine medial groove and an elongated spot not continued on the vertex. Thorax smooth and shiny. A narrow band on the fore margin continued laterally to the hind margin. A lateral medial band joins the side marginal stripe. From the disk of the thorax arising from the lateral band, a longitudinal stripe to the posterior margin, forming the letter T. Elytra very finely wrinkled like leather with very pronounced longitudinal puncture rows. Each elytron with four longitudinal stripes, which run together at the basal margin and in the apical triangle. A narrow subsutural stripe in the apical half of each elytron not quite reaching the apex. The broadest stripes are the one located between the second and third rows of punctures and the lateral marginal stripe, both of which are also broader toward the base and toward the apical triangle. Underside with a spot on the meso- and the metasternum. First abdominal segment with a large spot on either side. Each femur with a scale spot in the middle and a ringlike spot near the apex.

Length, 11.5 millimeters (without rostrum); width, 5.5.

LUZON, Benguet, Mount Santo Tomas (*W. Schultze*). Type in my collection.

This species belongs to Heller's group V.[6]

Eupachyrrhynchus hieroglyphicus sp. nov. Plate I, fig. 4.

Female.—Black, each elytron with four greenish or bluish white longitudinal stripes. Rostrum comparatively broad, strongly and confusedly punctured at the apex. A prominent quadratic depression in the basal half, the lateral edges of which are strongly keeled. Inside of the depression a fine longitudinal groove, extending to the frons. Thorax with a narrow transverse spot laterad of the middle, another larger one at the base, and a still larger spot on the lateral margin. Elytra with irregular longitudinal rows of punctures. Each elytron with four stripes. The dorsal pair at the base interrupted, forming two spots, afterward combined and at the disk separated again, forming a peculiar loop posterior of which the stripes approach each other and separate again, forming a second loop at the hind slope. Another, rather wavy lateral stripe and another, the broadest stripe, near the outer margin. The two latter run together at the base, and all four stripes are confluent in the apical triangle. The striped areas are very distinctly depressed. Suture and costal margin apically with a few fine hairs. Apical

[6] *This Journal, Sec. D* (1912), 7, 303.

ends of the elytra acutely divergent. Legs sparsely and indistinctly punctured, beset with fine hair, especially the tibia.

Length, female, 16.5 millimeters (without rostrum); width, 7.75.

LUZON, Benguet, Baguio. Type in my collection.

Macrocyrtus ? benguetanus sp. nov. Plate I, fig. 8, ♀.

Dark brown, almost black. Rostrum shagreened and irregularly punctured, fine hair arising from the punctures. A moderate longitudinal depression which is continued between the eyes as a fine groove to the vertex. Bronze-green scales scattered over the punctured area of the rostrum and frons. Antennæ beset with fine white hair, first funicular joint the longest, second almost as long as the first, the following short, each about one third the length of the second joint. Thorax sparsely punctured, with a prominent median and a rather indistinct anterior marginal groove. The punctuation in the female obsolescent. A broad bronze-green dorsolateral fascia from fore to hind margin interrupted cephalad, thus forming a small nearly round spot at the margin. A similar ventral-lateral fascia, certain scales of which extend to the margin of the acetabula. Elytra strongly punctured in irregular longitudinal rows, in the female strongly suffused. Each elytron with three longitudinal fasciæ, two of which are dorsolateral, the other at the outer margin. The same are irregularly interrupted before and behind the middle, forming irregular spots, the basal and the apical spots being the largest. Elytra beset with fine, scattered hair, especially toward the costal and apical margin. Legs reddish brown and hairy. Fore tibia only, below, with fine tubercles or blunt teeth. Apical ends of the elytra of the male acutely rounded, in the female acutely divergent.

Male, length, 10 millimeters (without rostrum); width, 3.5. Female, length, 12 (without rostrum); width, 5.

LUZON, Benguet, Mount Santo Tomas (2,250 meters). Types in my collection.

Var. **montanus** nov. Plate I, fig. 9, ♂.

Castaneus brown. Rostrum with the longitudinal depression less pronounced than in the typical form. Thorax with the median groove almost absent. The fasciæ very broad, especially on the elytra. Legs red, the apical half of the femora and the tarsi dark brown.

LUZON, Benguet, Haight's Place (2,700 meters).

The species *benguetanus* I place for the present provisionally

in the genus *Macrocyrtus*, which includes already some generically rather different species that should be rearranged when more is known about the group. The latter contains so far the species *nigrans* Pasc., *castaneus* Pasc., *subcostatus* Heller, *negrito* Heller, and *erosus* Pasc. The last-mentioned species is quite different in general appearance and form from the first four species, the main difference being that the elytra of the former are depressed dorsally, whereas in *erosus* Pasc. the elytra are inflated more as in *Pachyrrhynchus*. *Macrocyrtus negrito* Heller represents an intermediate form.

Nothapocyrtus luzonicus sp. nov. Plate I, fig. 6.

Castaneus, very glossy. Rostrum with irregular and scattered punctures. A large, shallow depression and an indistinct longitudinal groove terminating between the eyes. Thorax finely and irregularly punctured, with a large light green or bluish scale spot at the lateral margin. Elytra with distinct longitudinal rows of punctures. Each elytron with four lapis lazuli colored spots, as follows: Two at the base, one of which is near the suture, the other at the lateral margin; another long and narrow spot apically at the lateral margin; and one in the apical triangle. Besides the above-mentioned spots are indications of another, in the female only, at the lateral margin before the middle. Female with the suture apically strongly elevated and the sutural ends dull-pointed, in the male the latter are evenly rounded. Meso- and metasternum with a scale spot laterad. Metasternum and first abdominal segment of the male with a longitudinal depression in the middle. Legs with fine scattered punctures, a hair arising from each puncture.

Male, length, 11 millimeters (without rostrum); width, 4.5. Female, length, 12 (without rostrum); width, 5.

LUZON, Benguet, Haight's Place. Types in my collection.

I place this species provisionally in the genus *Nothapocyrtus* Heller, since *luzonicus* is congeneric with *N. cylindricollis* Heller.

Artapocyrtus sexmaculatus sp. nov. Plate I, figs. 11, 11*a*.

Glossy black, related to *A. quadriplagiatus* Roel., but the ventral side of the rostrum not armed with the conical projection as in the latter species. Rostrum densely punctured, a medial groove on the basal half reaching to the frons between the eyes. A prominent, deep transverse groove at the base of the rostrum. Underside of rostrum (Plate I, fig. 11) somewhat resembling that of *A. pardalis* Heller. Thorax equal in length and width,

globular, and with fine, scattered punctures. The female only has a flat depression with fine transverse wrinkles somewhat anterior of the hind margin in the discal area of the thorax. In the middle of the lateral margin a very light pinkish white scale spot of about double the size of the eye. Elytra irregularly punctured in rows, the puncture rows next to the outer margins running together, groovelike. Each elytron with 2 (♂) or 3 (♀) lateral pinkish white scale spots, one of which is located at the base and the other at the beginning of the apical third. The female has besides the above-mentioned spots another small one in the discal area between the second and third rows of punctures. Still another is more or less indicated at the margin in the apical part of the elytra. Anal segment of the female with two longitudinal impressions as in *A. pardalis* Hell.

Female, length, 11.5 millimeters (without rostrum); width, 5. Male, length, 10.5 (without rostrum); width, 4.5.

CATANDUANES, Virac. Types in my collection.

Metapocyrtus carinatus sp. nov.

Black. Rostrum strongly coriaceous, with a prominent longitudinal groove. The former triangularly set off between the eyes. Frons also coriaceous. Vertex smooth. Antenna finely pilose, especially the club, scape reaching slightly beyond the fore margin of the thorax. First funicular joint double the length of the second, each of the following joints half as long as the second (and equal among themselves). Thorax strongly coriaceous, with a marginal groove posteriorly only. Elytra prominently carinate, the interspaces with a coriaceous appearance. Elytra of the female with a large pubescent sutural tubercle at the posterior slope and an apical protuberance forming a short thornlike projection. Elytra of the male normally developed. Legs less pronounced coriaceous and beset with silvery gray hair, especially the tibiæ and tarsi. Hind femora of the female reaching beyond the apex of the elytra, hind femora of the male extending nearly half of their length beyond the elytra.

Male, length, 9 millimeters (without rostrum); width, 2.75. Female, length, 10 (without rostrum); width, 3.5.

LUZON, Benguet, Haight's Place (2,700 meters). Types in my collection.

This species seems to be related to *M. cylas* Hell.,[7] assuming that Heller's description refers to a male.

[7] *This Journal, Sec. D* (1912), 7, 359.

Metapocyrtus furcatus sp. nov. Plate I, figs. 10, 10*a*, ♀.

Black with large light green scale spots. Rostrum in the apical part minutely, confusedly punctured. A well-pronounced longitudinal depression expanded toward the front and terminating between the eyes. The punctuation in the broad portion of the depression or groove and up to the frons strong and confused. From the puncture arise very fine hairs. A large scale spot between the eyes. Sides of the head similarly scaled. Thorax longer than broad, strongly and confusedly punctured. A large, lateral, oblong scale spot and a broad fascia above the hips extending from the anterior to the posterior margin. Elytra irregularly punctured in rows. Female with seven large scale spots on each elytron. A prominent and finely bristled and scaled sutural double tubercle at the beginning of the hind slope of the elytra. Sutural end of each elytron drawn out thornlike and bent outward, forming a fork-shaped appendix. Male without the above-mentioned double tubercle and the sutural ends of the elytra uniformly rounded. The spots in the female are located as follows: Two oblong oval spots at the base, one subsutural, the other outer marginal, another, the smallest subsutural spot, at the disk. Still another subsutural oblong oval spot at the hind slope and next to the tubercle. An irregular triangular spot at the apical area. Another large oblong marginal spot scarcely separated from that in the tip triangle, and a large somewhat rectangular spot, which is located laterad to the small one at the disk and runs obliquely caudad. The spots vary, some are joined, others are divided, the latter being generally the case in the male. Legs beset with fine silver grayish hair. Tibia below with a few fine teeth and more strongly haired. Thorax below and abdominal segment similarly finely hairy.

Male, length, 8 millimeters; width, 2.5. Female, length, 10; width, 3.5.

LUZON, Benguet, Mount Mirador (*W. Schultze*). Types in my collection.

The male of this species has a superficial resemblance to *Notapocyrtus alboplagiatus* Heller. The female is to be recognized at once by the peculiar forked sutural apical ends of the elytra (Plate I, fig. 10*a*).

ILLUSTRATIONS

[Drawings by W. Schultze.]

FIG. 1. *Acronia pretiosa* sp. nov. × 1.5.
2. *Pachyrrhynchus igorota* sp. nov. × 1.5.
3. *Pachyrrhynchus loheri* sp. nov. × 1.5.
4. *Eupachyrrhynchus hieroglyphicus* sp. nov. × 1.5.
5. *Pachyrrhynchus zebra* sp. nov. × 2.
6. *Nothapocyrtus luzonicus* sp. nov. × 2.
7. *Pachyrrhynchus schuetzei* sp. nov. × 2.
8. *Macrocyrtus benguetanus* sp. nov. × 1.5.
9. *Macrocyrtus benguetanus* var. *montanicus* nov. × 1.5.
10. *Metapocyrtus furcatus* sp. nov. × 2.5; 10*a*, dorsal view of apical area.
11. *Artapocyrtus sexmaculatus* sp. nov., lateral view of head; 11*a*, front view of head.

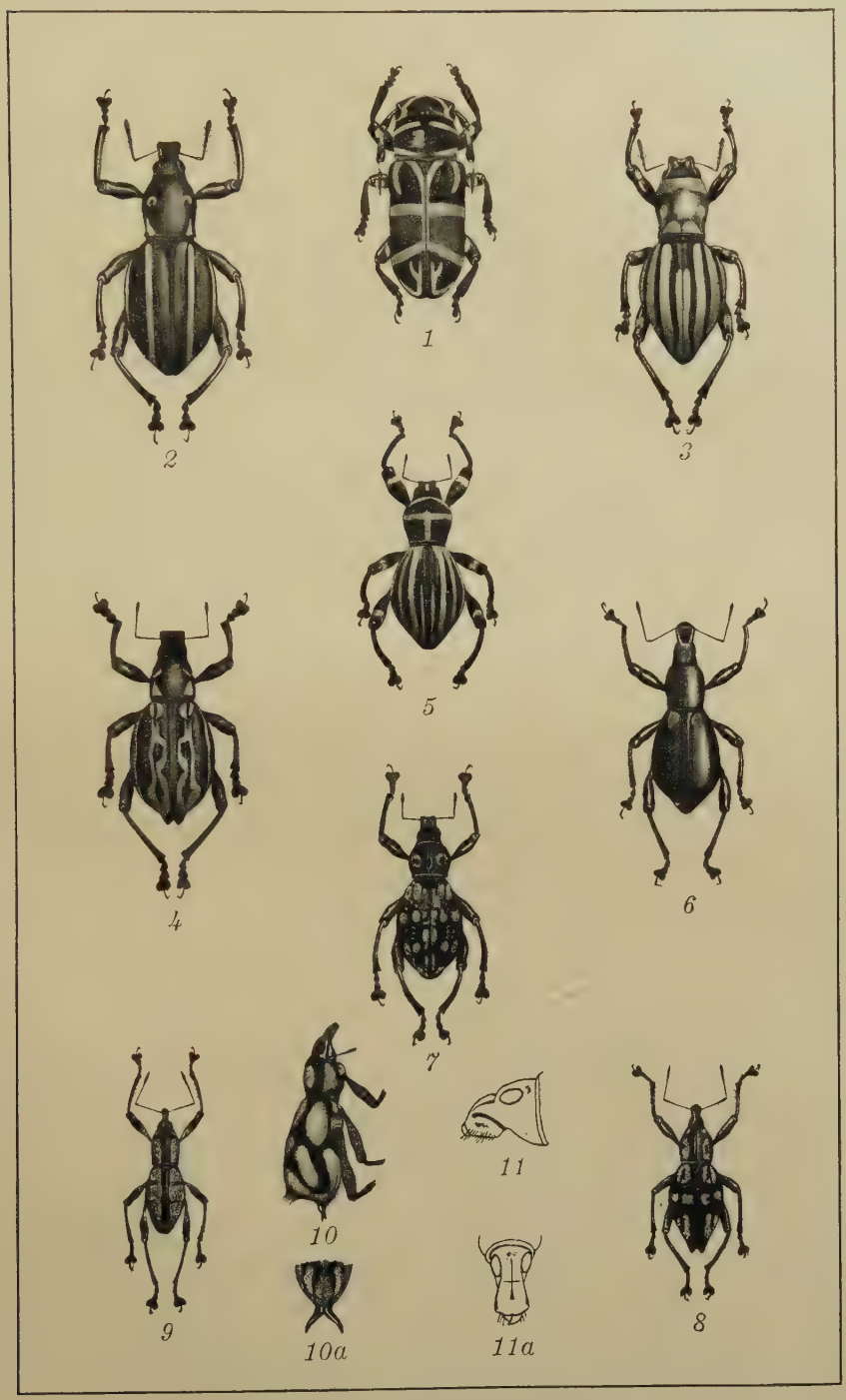

PLATE I. NEW PHILIPPINE COLEOPTERA.

REVIEWS

The Fundus Oculi of Birds | especially as viewed by the | Ophthalmoscope | A study in | comparative anatomy and physiology | by | Casey Albert Wood | Illustrated by 145 drawings in the text; also by sixty-one | colored paintings prepared for this work by | Arthur W. Head, F. Z. S. | London | Chicago | The Lakeside Press | 1917 | Cloth, pp. 1–182. Price, $15.00.

The Fundus Oculi of Birds is evidently a work of love, a byproduct in the life of a busy professional man, the utilization of the skill of the oculist in the study of a specialized branch of ornithology.

The author clearly shows the difficulty involved in the production of a work such as he has given us the pleasure of reviewing. As he says (p. 36):

> The ophthalmologist may be a good observer but a poor artist; conversely, an expert in the use of brush and pencil may not be sufficiently conversant with normal and pathological, human and comparative ophthalmoscopy and ophthalmology to enable him to make an intelligent use of his artistic talents.

Fortunately Doctor Wood has been able to combine his own technic with the rare artistic experience and ability of Mr. A. W. Head, and thus to present a wonderful collection of colored pictures of the fundus oculi.

Following the Introduction and Summary of Conclusions the chapters deal with collection, selection, and preparation of material and bibliography; anatomy of the fundus organs in birds; ophthalmoscopy of the vertebrate eye; ophthalmoscopy of the fundus in living birds; fundus oculi of birds in prepared specimens; effects of domestication on the fundus oculi; the fundus appearances in various orders of birds; classification of the ocular fundi of birds; classification of Aves and the fundus oculi, and the relations of reptilian to avian fundi.

The fundus oculi of birds, in simple words, is the posterior wall of the eye, and as seen through the pupil in the living bird by means of the ophthalmoscopy, it presents a picture entirely different from that seen in the eye of any other vertebrate. Doctor Wood has examined the eyes of representatives of nearly all the avian orders and

> believes that as the fundus appearances in wild species are probably invariable and that, as the evidence so far produced shows, each species

exhibits a background picture distinct in one or more particulars from every other species, it is possible to identify many of them by the use of the ophthalmoscope alone; * * *. [p. 114.]

Colored plates show that there is much difference in the fundus of different genera, but in only one case has the author illustrated the fundi of two species in the same genus, namely, *Haliaëtus leucocephalus* and *H. leucogaster*, illustrated on plates 33 and 34, respectively. The ocular fundi of these two species seem to be somewhat similar to each other, but that of the latter seems to be more similar to the fundus of *Tinnunculus alaudarius*, plate 35, than to the fundus of *H. leucocephalus*. Doctor Wood says (p. 115):

The arrangement of the centres of distinct vision, the fundus tints and the pectinate tissues of the larger *Acciptriformes* present a decided ophthalmoscopic resemblance in all the species so far examined by the writer.

A series of plates illustrating the fundi of half a dozen or more species in one genus would be interesting. With regard to characteristic colors of the fundus, Doctor Wood says (p. 114):

When a bird and his ancestors (in the evolutionary sense) have used their eyes for distinct visualization largely or exclusively at night the fundus tint is nearly always yellow or orange.

Another observation of avian fundi seems to show that an admixture of yellow (in the form of an orange-red coloration) may be present to indicate not so much recent as former, i. e. atavistic, night habits long since abandoned by the species.

This almost universal occurrence of yellow or orange-tinted fundi in Night Birds leads one to speculate as to the cause of a different coloration in species that, during historic times at least, have used their eyes largely or exclusively after dark. At least some of the Ardëiformes furnish such examples.

The paper, type, press work, and binding of this book are such as to produce a pleasing and satisfactory volume.

R. C. McG.

Heridity in Relation | to Eugenics | by | Charles Benedict Davenport | [5 lines] | [ornament] | New York | Henry Holt and Company | 1913 | Cloth, pp. i–xi+1–298.

Heredity in Relation to Eugenics is a most welcome contribution to the literature of the subject, not only because of the many facts presented, but also because of the clear, sound, and temperate analysis which the author has made of them. What is given here is no more than a brief abstract of this book, and it should be said that the work is an excellent one for those who are interested in the subject, as it covers the field in an adequate manner and avoids those severely technical discussions that

are difficult of comprehension by the ordinary reader, as well as theories that are not widely accepted.

There is a general impression that books upon heredity are gloomy and pessimistic; that they teach that the deficiencies of the parents are inevitably inherited by the children; and that as acquired characteristics are not transmitted there is no chance for mental, moral, or physical improvement. According to this idea, since the career of each individual would be predetermined from his birth, there would be no room for free will, all striving for improvement would be useless, and the very foundations of ethics and of religion would be undermined.

Doctor Davenport's presentation of the subject is distinctly hopeful, as it makes clear that only mental and moral tendencies are usually inherited, and that these can be inhibited, cultivated, and modified, within certain limits, by training, formation of habits, and education. Social environment and deliberate choice and effort are factors that may improve many individuals, though there are persons of the lower types who are not able to advance themselves consciously. Thus the underlying conviction of most thinking people that the larger number of individuals are responsible for their acts is shown to be well founded, and heredity takes its place with environment as one of the factors influencing conduct, instead of being an overmastering power against which it is useless to struggle.

Notwithstanding this encouraging attitude, the author maintains, in no equivocal terms, the commanding importance of eugenics, which he defines as "the science of the improvement of the human race by better breeding," and he even goes so far as to say: "Man is an organism—an animal; and the laws of improvement of corn and of race horses hold true for him also. Unless people accept this simple truth and let it influence marriage selection human progress will cease."

The expense in the United States of caring for the insane, the feeble-minded, criminals, and other defectives shows an enormous and disproportionate increase from year to year and has led some writers to deplore the undue sentimentality of modern society in encouraging the multiplication of the unfit, who otherwise would have been eliminated. The statement is made that one fifth of the total revenues of some states in the United States is devoted to the care of the unfit, and that we support about half a million insane, feeble-minded, epileptic, blind, and deaf persons, with, in addition, 80,000 prisoners, and 100,000 paupers, at a cost of over 100,000,000 dollars a year. Besides this stag-

gering total, there are many other defectives, who are not in institutions and who are a constant menace to society.

Davenport's views on the question of the best methods of diminishing the transmission of undesirable physical and mental traits are perfectly definite. After discussing the sterilization of the unfit from various points of view, he concludes that the lower grades should be segregated in institutions, while the nearly normal people should be educated as to fit and unfit matings.

This is one of the few subjects that he has not treated in a satisfactory manner, as many persons might feel that his own tables could be easily interpreted to confute the author's conclusions as to the social expediency of the marriage of the higher grades of the mentally defective, while the expense of the proposed adequate segregation would be prohibitive.

However, he is not unaware of the logical deductions from his presentation of the facts, for he writes, "There is no question that if every feeble-minded, epileptic, insane, or criminalistic person now in the United States were operated on this year there would be an enormous reduction of the population of our institutions 25 or 30 years hence; * * *."

A more complete discussion of the relation of drunkenness to defectiveness would add to the usefulness of the book, as some authors regard alcoholism as the cause of deficiency, while almost all feel that the two are very intimately related. Therefore it may be desirable to include drunkards in the list of those who should not be permitted to burden society with their progeny.

Apparently the author's sympathy for the individuals who are less favored by nature tends, in this instance, to outweigh the interests of society, and he may possibly place too much importance upon the usefulness to society of the offspring of the high-grade defectives.

On the other hand, he emphasizes the importance of proper marriage in the words "proper matings are the greatest means of permanently improving the human race—of saving it from imbecility, poverty, disease, and immorality."

The section on the sociological aspect of eugenics is of especial interest, for his explanation "the traits of the feeble-minded and the criminalistic are normal traits for infants and for earlier stages in man's evolution" gives an additional instance of the biological truth that "the individual (ontos) in its development passes through stages like those the race (phylum) has traversed in its evolution." We are forced "to conclude that these traits have come to us directly from our animal ancestry and have

never been got rid of" by those whom we class as defectives, and who in many cases are merely instances of arrested or imperfect development. The universal processes of evolution tended to eliminate those individuals who were not adapted to their environment, and so society gradually freed itself from unsocial strains by the simple process of the imprisonment or execution of those individuals who were a menace to the welfare of their fellows. The author faces the situation with courage and does not hesitate to say (p. 263):

> We are horrified by the 223 capital offenses in England less than a century ago, but though capital punishment is a crude method of grappling with the difficulty it is infinitely superior to that of training the feeble-minded and criminalistic and then letting them loose on society and permitting them to perpetuate in their offspring these animal traits. Our present practices are said to be dictated by emotion untempered by reason; if this is so, then emotion untempered by reason is social suicide. If we are to build up in America a society worthy of the species *man* then we must take such steps as will prevent the increase or even the perpetuation of animalistic strains.

The deductions of heredity give little support to those philanthropists who think that all criminals are merely the victims of social injustice and that the children of criminals will always make good citizens if placed in a proper environment. The pedigree of the Juke family, which up to 1877 had cost New York State over 1,250,000 dollars, and is still multiplying, and those of the "Ishmaelities," Owens, and many other families show that defective parents will almost inevitably have defective offspring. Many instances are given of children with defective ancestry, but with excellent surroundings from an early age, who have proved incorrigible.

In support of these various conclusions, Davenport gives a logical and well-arranged discussion—though it is possibly too condensed—illustrated by many tables of the method and mechanics of heredity, covering the fertilization and multiplication of the germ cells, the transmission of determiners and unit characters, and the Mendelian theories of the inheritance of dominant and recessive characters.

One of the best bases for the study of the interaction of these factors is the inheritance of family traits, since we have here available a considerable number of facts regarding the transmission of the color of the eyes, hair, and skin; the energy, stature, weight, form, and peculiarities of the body; the appearance of mechanical, mathematical, mental, literary, musical, and artistic ability; and the susceptibility to various diseases of the

nervous, muscular, vascular, alimentary, and respiratory systems, as well as to maladies of the eyes, ears, skin, glands, and blood. The list is astonishingly long, and the evidence is abundant. The studies of feeble-mindedness, insanity, pauperism, and criminality are especially convincing.

Chapters are also devoted to the geographic distribution of inheritable traits and to migrations and their eugenic significance. Of special interest is the chapter on the influence of the individual on the race.

The author closes with a strong plea for a thorough study by the various States, by means of eugenic surveys made by the school teachers, of all their families, for the purpose of recording the good and the bad traits of each strain, with a view of eliminating the latter. He feels that society has a right to this information, in spite of the unwillingness to give it that may be felt by individuals, and he meets the objection that such a survey is impracticable by the assertion that a similar one is well advanced in New Jersey, largely through private initiative, by means of field-workers attached to various institutions for defectives. He also thinks that there should be a national clearing house to collect the information collected by the various states.

C. C. BATCHELDER.

Truth | and | Other Poems | by | Paul Carus | [cut] | Chicago | The Open Court Publishing Company | MCMXIV | Cloth, pp. 1–61. Price, $1.

The | Mutation Theory | Experiments and Observations | on the | Origin of species in the Vegetable | Kingdom | by | Hugo de Vries | professor of botany at Amsterdam | translated by | Prof. J. B. Farmer and A. D. Dabishire | Volume II | The origin of varieties by mutation | with numerous [text] illustrations and six colored plates | Chicago | The Open Court Publishing Company | London agents | Kegan Paul, Trench, Trübner & Co., Ltd. | 1910 | Cloth, pp. i–viii+1–683. Price, $4.